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ABSTRACT

This book traces the High Schools That Work program from its inception and reports on practices that are helping schools effectively integrate academic and vocational education. Examples are included to illustrate what can be accomplished. Chapter 1 describes the program's goals, key practices, key conditions, and success. Chapter 2 shows how schools are proving it is possible to raise expectations if the curriculum is relevant, students feel they are respected, and teachers and administrators work together. Chapter 3 focuses on integrating high-level academic with vocational studies through use of applied learning methods. Chapter 4 discusses integrating academic content into vocational courses with design of a new vocational program as the ultimate goal. Chapter 5 describes characteristics of a team of vocational and nonvocational teachers and ways in which they work together. Chapter 6 focuses on developing a challenging double-purpose program of study that combines vocational and academic content to prepare students for future learning at work and in postsecondary education. Chapter 7 discusses roles and responsibilities of the guidance counselor, teachers, and parents in the guidance process. Chapter 8 describes areas in which teachers need extra help and the form that help should take. The final chapter discusses why schools need to change and benefits of change. Annotations of 10 resource organizations are appended. An index is provided. (YLB)

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*Through Integration of Academic
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Southern Regional Education Board

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Making High Schools Work

***Through Integration of Academic
and Vocational Education***

Gene Bottoms, Alice Presson, and Mary Johnson

Southern Regional Education Board
592 Tenth Street, N.W.
Atlanta, Georgia 30318-5790

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The SREB Vocational Education Consortium

**Dedicated to Strengthening the Basic Competencies of
Students Enrolled in Vocational Education Programs**

**Alabama, Arkansas, Delaware, Florida, Georgia, Indiana, Kansas,
Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma,
Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and
West Virginia**

**In collaboration with
The Southern Regional Education Board (SREB)
and**

**The National Center for Research in
Vocational Education (NCRVE)**

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Foreword

BY THE YEAR 2000—

Significant gains will be achieved in the mathematics, sciences, and communications competencies of vocational education students.

Goals for Education
CHALLENGE 2000

In 1987, the Southern Regional Education Board launched an ambitious project designed to dramatically change the future of students in general and vocational programs of study—and the future of their schools. The SREB-State Vocational Education Consortium was founded on the premise that high schools can change what happens to the “other” students—those who do not fit easily into the college preparatory track. The Consortium is doing this by:

- Changing what students are taught;
- Changing how they are taught;
- Changing what schools expect of students;
- Changing how academic and vocational teachers relate to each other and to the students they teach.

Initially supported by 13 states, in 1992 the Consortium included 19 states with 100 sites using SREB-recommended strategies. More states and sites are joining every year.

This book reflects the experiences of a group of high schools in transition. These schools are moving from an old model in which too little was expected of students enrolled in general and vocational courses, to a new model in which these students are expected and encouraged to achieve higher academic and vocational standards.

SREB's recommendation for students planning to go to work or to attend a two-year postsecondary institution combines col-

iege preparatory level academic courses with modern vocational courses in a planned program of study. The vocational courses should integrate challenging academic and technical content, and the academic courses should be taught in a way that engages students in authentic learning activities and allows them to apply the knowledge to real-world situations.

We are indebted to states, school systems, administrators, and teachers who have demonstrated with their vision and dedication that it is possible to make a "dramatic shift" in how high schools prepare students, whether they plan to find a job or to attend college after graduation. These tough-minded but caring educators have said, "We have not done enough for these students, and we are willing to work hard to make major changes in what and how we teach them."

We do not claim to have launched a revolutionary change or to have set in motion a "paradigm shift." We do believe—in fact we know—that this program works. Schools are getting results. Schools are making important, fundamental changes that are making a difference in the lives of students.

The *High Schools That Work* program is reaffirming what SREB has believed throughout its history—that all students can meet higher standards. This project is one way to redesign high schools around the concept of "effort." The new design proposes that students who are motivated to put forth a solid effort can master higher-level academic content, regardless of their perceived ability or their past performance:

This program is far more than another small-scale educational experiment that will dissolve in the wake of the next instructional reform. It is doing what all high schools must do: come to grips with how to teach large numbers of students what they will need to become productive workers, and responsible citizens and family members, in an increasingly complex world.

Mark D. Musick
President
Southern Regional Education Board

Acknowledgments

With this book, SREB honors an ongoing commitment to share information about successful ways to improve the high school experience and achievement of career-bound students.

The book traces the *High Schools That Work* program from its inception and reports on its rapid expansion and positive results. It incorporates the feelings and experiences of dozens of school superintendents, principals, teachers, counselors, and others.

State Vocational Directors in the SREB states deserve special recognition. They had the vision in 1985 to approach SREB about launching a joint effort aimed at integrating academic and vocational education. They have been generous with discretionary funds and other resources as SREB and the states shaped an initiative that has become the nation's first large-scale effort to bring the academic and vocational communities together.

We are indebted to our State Coordinators, who have demonstrated exceptional leadership and determination in upgrading the education of career-bound students. As a point of contact in each state, they have provided guidance to the program and a willingness to implement new practices. The coordinators unselfishly set aside time to read a draft copy of the book and to offer their suggestions for improvement.

The National Center for Research in Vocational Education is a source of much insight about the progress of school sites and the achievement of students in the *High Schools That Work* program. Many of the charts and tables in this book would not have been possible without the critical data that NCRVE provides to school administrators and to the program.

SREB is extremely grateful to the many school site leaders and teachers who are dedicated to making the vision a reality. They have joined a network where they participate actively with other schools—where they examine what works and share and incorporate the best practices. Their day-to-day efforts make a difference for young people who attend high school now and in the future. They cheerfully responded to our questions and generously shared real-life examples to illustrate the challenges

and victories that front-line educators experience as they make substantial changes in how high schools prepare career-bound students.

Much of the initial word processing and table preparation for this book was done by Gretchen Garrett of the Consortium staff. The SREB Publications Office under the direction of John Norton managed the editing, layout, and production of this book. Special thanks are due to Margaret Sullivan for her careful attention to detail, and to Leticia Jones for an outstanding performance on her first major desktop publishing project.

Introduction

Travis Gordon, a college student in South Carolina, speaks for literally thousands of young people across the nation when he accuses his high school of failing to prepare him for either work or college. Because he "cruised through" school in a succession of undemanding courses, this young man is faced with spending large amounts of time and money for "catch-up" courses on a community college campus. Like many other high school graduates, Travis was educated below his potential. No one expected him to achieve in high school—and he didn't.

The SREB-State Vocational Education Consortium is helping states and schools unlock the potential of students who have been overlooked or "accommodated" in the past. A nagging question guides our work: "What can high schools do to make sure *all* students, not just the 'best' ones, master the complex subjects that contribute to future success?"

This book is based on SREB's experience with a network of states, schools, and individuals actively working to make a difference in the lives of high school students in general and vocational programs of study. Written for educators who want to advance academic competencies through effective integration of academic and vocational education, the book contains practical advice from administrators, principals, teachers, counselors, and others.

The material for the book was gleaned from speeches and workshops at the Consortium's annual staff development conferences; reports from visits to pilot sites; in-depth interviews with administrators, principals, pilot site coordinators, academic and vocational teachers, and counselors; student scores on National Assessment of Educational Progress (NAEP) tests; analyses of the courses high school students take and what students do after high school; and case studies of sites where students made the greatest gains in academic achievement from 1988 to 1990.

You will find a framework of goals, practices, and processes high schools are using to achieve the kind of dramatic changes in the educational system that are necessary to prepare students for

life and work in the next century. We do not limit our discussion to abstract concepts; we include real-life examples to illustrate what can be accomplished. Some concepts, such as team teaching and the importance of support from the administration, are relevant in several chapters; therefore, you may find certain basic concepts presented in more than one place in the book.

We have been candid about problems and realistic about the time and commitment required to make a concept work. Much of what we present are snapshots—impressions of a network of high schools in midstream as they strive to do a better job of serving students enrolled in general and vocational programs of study.

Chapter 1

CHANGING HIGH SCHOOLS: A VISION OF WHAT WILL WORK

American education must change. National and regional reports issued one after another for the past decade have warned that education is failing to meet the needs of many of the nation's youth.

This failure has economic and social consequences, causing America to fall behind in the international marketplace and incur spiraling costs for welfare programs, social services, and prisons.

As studies pinpoint problems and recommend solutions, increasing attention has been directed toward the high school. The reason is obvious. For many students, high school represents their best chance to prepare for work and further learning.

A third of all high school students may be classified as vocational-technical education students (taking six or more vocational courses), according to the 1989 National Assessment of Vocational Education. Even though vocational-technical students have the advantage of majoring in a vocational field, many concerns have surfaced about the effectiveness of vocational as well as academic classes in helping these students develop needed academic skills.

Questions about the high school general track are even more critical. Approximately one-third of high school students are in this track, a basically unplanned program of study that fails to prepare young people for either college or work. Students in "general" programs take a random selection of courses that lead nowhere, exiting high school with a diploma that is practically worthless.

The Quest for Quality

Two years before the landmark study *A Nation at Risk* alerted Americans to the crisis in education, the Southern Regional Education Board (SREB) voiced a need for education to put its house in order. In *The Need for Quality*, published in 1981, SREB challenged states, schools, and colleges to work cooperatively to develop higher academic standards and levels of achievement for all students. SREB's recommendations included upgrading teachers and other school personnel, and strengthening the curriculum and the high school-college connection.

Following publication of *A Nation at Risk* in 1983, policymakers and educators across the nation set to work to fix the educational system. The ultimate goal—to raise the performance of all students—remains elusive. The initial approach was to increase the number of academic courses required for high school graduation. Virtually every state in the nation took this approach, which had the effect of improving the academic competencies of students enrolled in traditional college preparatory programs of study. For many students in general and vocational programs, however, the approach meant minimum basic skills testing; another year of repetitive, lower-track English, mathematics, science, and rudimentary vocational courses; and remedial studies at the expense of challenging vocational studies.

SREB recognized very early that simply requiring students to take more academic courses was unlikely to produce results, particularly if those courses were weak in content and presented in a way that meant little to the majority of students. The goals of the reform movement would not be achieved for one-half or more high school students unless they had access to the essential content of college preparatory language arts, mathematics, and science courses and to modern, demanding vocational courses.

Accordingly, SREB recommended that states seek ways to blend higher-level academic courses with quality vocational studies, especially for students who grasp information more readily through practical applications than through abstract learning modes. The recommendation assumed that academic education might not be the only way to improve the high school experience; an effective mixture of both academic and vocational studies might be a way to achieve a common goal of preparing high school graduates to work and learn. Low-level courses—whether vocational or academic—would simply have to go.

In 1985, the SREB Commission for Educational Quality developed a statement designed to make academic skills a priority for vocational as well as academic educators (see page 4). SREB's *Recommendations for Improving High School Vocational Education* included two major themes:

- Vocational education must become a full partner in improving the academic skills of high school students;
- Each state should design pilot programs to merge vocational and academic education.

SREB set the scene for a historic shift in vocational education in high schools in the South—away from encouraging students to be “servants of technology” and toward preparing them to be “masters of technology.”

The SREB Consortium

Encouraged by the favorable response to the SREB report from vocational as well as academic leaders and spurred by opportunities of the 1984 Carl Perkins Vocational Education legislation aimed at strengthening the basic skills of vocational students, a group of progressive state vocational leaders approached SREB in late 1985. They envisioned a joint effort to implement the commission's recommendations in their states, and they wanted SREB to provide the leadership.

In meetings involving SREB and state vocational and academic leaders over the next two years, a plan was drawn for a multi-state network of *High Schools That Work* for students in vocational and general studies. Each participating state would support at least two pilot sites in pursuit of agreed-upon goals. SREB would manage the process, facilitating the exchange of information among the states and sites and conducting evaluation.

The SREB-State Vocational Education Consortium is an outgrowth of SREB's original recommendation for states to try new ways for vocational and academic educators to improve high school education. The Consortium's emphasis is on helping educators change high schools to meet the needs of all students.

National policymakers contributed to the drive to make academic skills a priority. The Perkins Act encouraged vocational

Recommendations for Improving High School Vocational Education

Strategies to make vocational education a full partner in improving high school students' academic skills:

- Require students in vocational programs to meet the same basic skill standards on high school competency tests as any student seeking graduation.
- Recognize and/or redesign certain vocational high school courses to meet graduation requirements, if such courses can be shown to lead to the mastery of specific learning outcomes of corresponding academic courses.
- Jointly develop, with assistance from both academic and vocational teachers, applied mathematics and science courses that take advantage of practical experiences to stress essential academic knowledge and skills.
- Remediate deficiencies in basic reading, writing, and arithmetic in poorly prepared high school students enrolled in vocational education courses.

Pilot state programs to merge vocational/academic education:

- Each state should appoint a task force of academic and vocational teachers to design pilot courses and programs that link academic learning to practical vocational applications and meet academic graduation requirements.
- Concurrent with the development of such pilot programs, pre-service and in-service programs as well as state program and licensing standards should be evaluated and strengthened to promote the academic competencies of vocational teachers and the applied teaching skills of academic teachers.

Actions to upgrade vocational programs:

- High schools, postsecondary institutions, and employers together should develop "two plus two" programs in which a planned four-year curriculum connects the last two years of high school with two years of postsecondary study along with planned, on-the-job learning.
- Joint enrollment programs should be encouraged in which high school students who have completed the prerequisites enroll in postsecondary technical programs while completing high school.
- Industrial arts courses beginning with the 9th grade should be redesigned to include content related to modern technology.
- Standards and initiatives for improving cooperative education as a method for on-the-job learning should be established.

Source: Southern Regional Education Board's Commission for Educational Quality, 1985.

educators to improve the academic foundation of students in their programs, and the re-authorized legislation approved by Congress in 1990 strengthened this goal. The Perkins legislation urges high schools to use federal money to integrate academic and vocational-technical education and to provide students with access to challenging academic and vocational programs of study. Many of the initiatives undertaken by the SREB Consortium are made possible by Perkins funds coupled with state and local allocations.

Two Major Goals

The Consortium has two major goals for its network of *High Schools That Work*:

- To increase the mathematics, science, and communication achievement of students in general and vocational programs to the national average by the year 2000.
- To integrate the basic content of traditional college preparatory studies—English, mathematics, and science—with vocational studies by creating conditions that support school principals and faculties in carrying out certain key practices.

Key Practices

Consortium leaders identified nine key practices aimed at helping students in general and vocational programs master higher-level academic content. The practices call for academic and vocational teachers to work together on programs of study that are more challenging for students and do a better job of relating what young people learn in high school to what they will do after graduation. The emphasis is on blending related vocational and academic studies in grades 9 through 12.

Key practices have the potential to create a learning pattern that enables students to make a connection between abstract academic studies and actual problems, tasks, and situations encountered in the workplace (see Key Practices on page 6).

Key Practices for Accelerating Student Achievement

High schools in the SREB Consortium are committed to finding ways to carry out the following practices:

- ✓ To establish higher expectations of students in both academic and vocational classes;
 - ✓ To revise vocational courses and develop new ones to expand significantly the emphasis on advancing the communication, mathematics, and science competencies of students;
 - ✓ To revise academic courses or develop new ones to teach concepts from the college preparatory curriculum through functional and applied strategies that enable students to see the relationship between course content and future roles they may envision for themselves;
 - ✓ To require students in general and vocational programs to complete a challenging and related program of study, including three courses in mathematics and three in science, with at least two credits in each course equivalent in content to courses offered in the college preparatory program. Students should also complete at least four courses in a vocational major and two courses in related areas;
 - ✓ To encourage vocational and academic teachers to integrate academic and vocational curriculum and instruction by providing them with staff development, materials, and time to work together;
 - ✓ To revise the instructional process so that the student is a worker and is actively engaged in the learning process;
 - ✓ To provide guidance and counseling services that help students see the connection between what they are learning in school and their goals beyond high school and to involve their parents in the process of planning and annually updating a high school program of study;
 - ✓ To provide extra help that will enable students to complete successfully a program of study that includes high level academic content;
 - ✓ To participate in and use student assessment and program evaluation information to check and improve the curriculum, instruction, school climate, and school organization and management.
-

Key Conditions

The Consortium believes six conditions are essential to create the proper environment for successful high school change. The conditions emphasize commitment by the school board, system superintendent, and school principal. The conditions describe an organizational structure that encourages faculty members to co-operate in developing action plans to implement the Key Practices (see Key Conditions on page 8).

SREB's Concept of Tech Prep for Making High Schools Work

Key Practices and Conditions form the basis for creating a Tech Prep program of study for vast numbers of students who do not pursue a traditional college preparatory program (see page 9). SREB sees Tech Prep as a blend of academic and vocational courses in a planned program of study equivalent to the college preparatory program. Students complete either a vocational or an academic major. Communication, mathematics, and science competencies are raised significantly, and the progress of these students is tracked and assessed.

When fully implemented, the Key Practices and Conditions enable a high school to create two parallel, more equal pathways through high school—a Tech Prep pathway for career and community college-bound students and a parallel pathway for four-year college and university preparatory students. Both pathways should contain the same basic curriculum of demanding college preparatory-level courses and should be flexible enough for students to move from one pathway to another.

SREB views Tech Prep as a structured high school curriculum, in contrast to some Tech Prep efforts that concentrate more on coordinating high school and postsecondary studies than on changing what students do in high school. At the same time, SREB does not discount the value of a close working relationship between high schools and two-year postsecondary institutions. High schools need to develop alliances with employers as well as community colleges to be more precise and more pro-active in helping teachers and students understand the new standards of higher education and the business world. The result will be high school graduates that meet employers' expectations and require fewer remedial courses in a postsecondary education program.

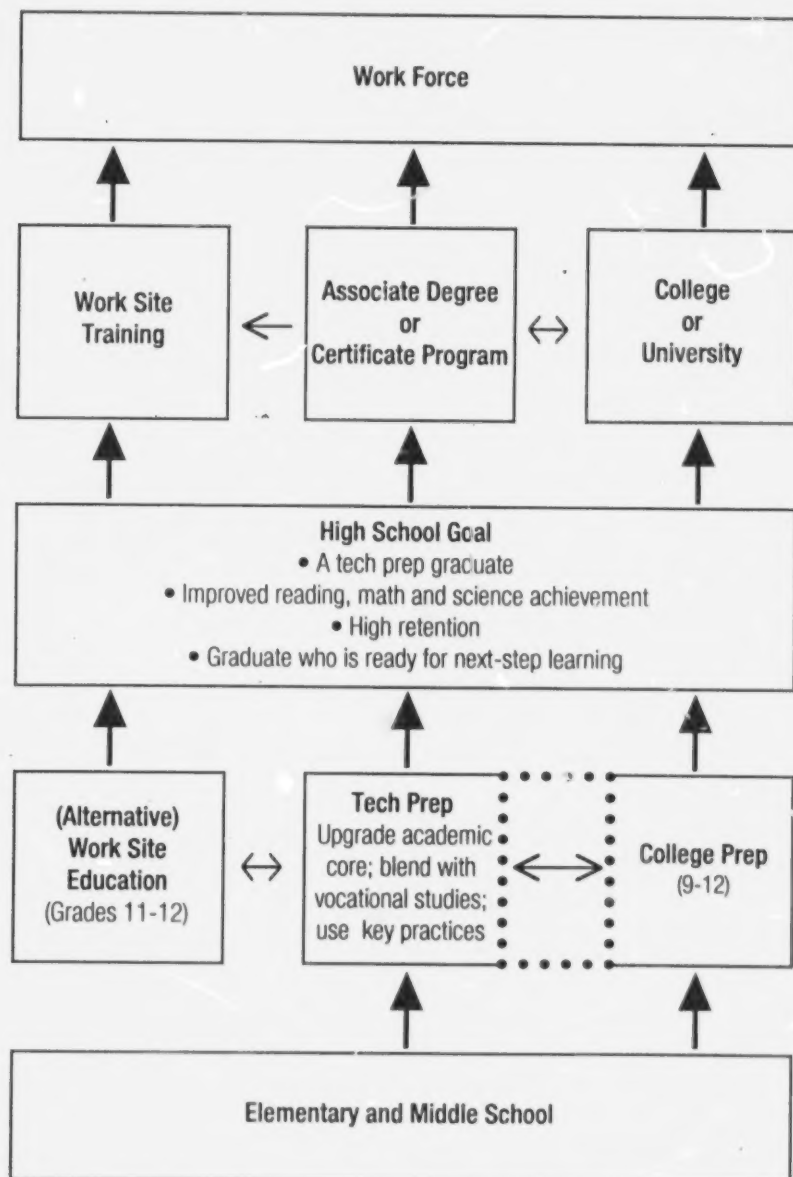
Key Conditions for Accelerating Student Achievement

System leaders of Consortium schools are committed to creating organizational and administrative conditions that include:

- ✓ An organizational structure and process through which the faculty can develop action plans for implementing the Key Practices;
 - ✓ A school principal with strong and effective instructional and administrative leadership who supports, encourages, and actively participates with the faculty in implementing the Key Practices;
 - ✓ A system superintendent and school board who support the faculty and school administration in carrying out the Key Practices.
 - ✓ Leadership from the school superintendent to involve employers and postsecondary institutions in the design and implementation of a dual purpose program of study aimed at preparing students for both postsecondary education and employment;
 - ✓ A commitment from the school board to support the school in dropping the general track or in dramatically reducing the number of high school graduates completing the general program of study over the next five years;
 - ✓ A commitment from the superintendent and school board to provide the necessary financial support for instructional materials, time, and staff development needed to implement Key Practices.
-

In implementing SREB's model of Tech Prep, high schools must begin to turn away from an "ability" model—an instructional approach based on the belief that only students with "innate" ability can learn and that very little effort should be made to get other students to work harder. SREB believes that most students can master higher-level academic content if educators and administrators believe they can and devise an instructional process that encourages students to make the effort. The instructional process should focus on *how* students learn as well as *what* they learn.

MAKING HIGH SCHOOLS WORK: SREB'S CONCEPT OF TECH PREP



High schools that adopt the SREB model are discovering that the following things happen:

- They begin to replace the general education track with the Consortium view of a Tech Prep program of study.
- All students complete an upgraded academic core with either a vocational or academic major.
- The academic and vocational curriculum is reorganized.
- The practice of teaching higher-level academic content to some students and lower-level content to other students is ended.
- New teaching methods are used to help students meet the higher academic standards.
- A parallel curriculum is established with interchangeable courses and opportunities for students to move between the two pathways.
- All students complete a structured and focused program of study.
- More students who complete a vocational program graduate with a required academic sequence.
- The high school does for all students what it has been doing for declared college-bound students only.

Forgotten Students

In 1988, findings from a two-year study of 16-to-24-year-olds focused national attention on the 20 million non-college-bound young people described by the William T. Grant Foundation as the "Forgotten Half." The study alerted many more people to the plight of students enrolled in general and vocational programs and gave national legitimacy to the effort SREB had already begun.

An array of statistical data points to the folly of ignoring the "other" students. The Bureau of Labor Statistics reports that more than 70 percent of jobs by the year 2000 will require less than a

baccalaureate degree. American students rank near the bottom on most international tests, and the United States lags behind other nations in economic growth in an increasingly global marketplace.

A growing outcry from American business about the need to raise the skills of young people entering the work force has fueled the movement to do a better job of serving all students. Dissatisfaction with the educational system was voiced loudly in a 1990 report titled *America's Choice: High Skills or Low Wages!* The report was written by the Commission on the Skills of the American Workforce, an impressive group of industry executives, policy analysts, and two former U.S. Secretaries of Labor. In a document that was startling and to the point, the commission stated that:

- The productivity of workers in jobs that do not require a college education will make or break our economic future.
- America has no system capable of setting high academic standards for youth who do not plan to attend a four-year college or university.

The answer, according to the commission, is to develop "high performance work organizations" where all workers are able to use good judgment and make decisions that directly affect the way a job is done.

"The tragedy is that we communicate to millions of students every year, especially to low-income and minority students, that we do not believe that they have what it takes to learn," the Commission said. "They then live up to our expectations, despite the evidence that they can meet very high performance standards under the right conditions."

The report recommended solutions to America's work force problems, including:

- A new national education performance standard for all students to be met by age 16. The standard should be "benchmarked to the highest in the world."
- A comprehensive system of technical and professional certificates and associate degrees for the majority of students and adult workers who do not pursue a baccalaureate degree.

In 1991, a report from the Secretary's Commission on Achieving Necessary Skills (SCANS) virtually echoed the concerns raised in *America's Choice* and expanded on the report's recommendations. This commission, created by Secretary of Labor Lynn Martin and chaired by former Secretary William E. Brock, studied what it takes to prepare young people for work. In the report, titled *What Work Requires of Schools*, the commission identified five competencies and a three-part foundation for solid work performance. Emphasizing the need for contextual learning, the competencies are similar to those the SREB Consortium developed in its early stages (see next page).

"The eight requirements [five competencies and a three-part foundation] are essential preparation for all students, both those going directly to work and those planning further education," the Commission said. "Thus, the competencies and the foundation should be taught and understood in an integrated fashion that reflects the workplace contexts in which they are applied."

The final SCANS report, *Learning a Living: A Blueprint for High Performance*, was issued in 1992. It describes how schools and the private sector can cooperate to create a high-performance economy.

Change Is Not Easy

Leaders of states participating in SREB's ambitious initiative have learned important lessons about changing education. They have learned that it is possible to improve the educational experience of students enrolled in general and vocational studies, but that it cannot be done overnight. It takes time and leadership, starting with acknowledgment from the top down that there is a problem.

The SREB Consortium recommends a method of change that includes decision-making by leaders of multiple states and shared planning, goal-setting, and problem-solving at the school building level.

Reviewing the events of the first few years, the Consortium has arrived at some important conclusions about dimensions of the task and barriers to achievement.

Workplace Know-How

The know-how identified by SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance. These include:

COMPETENCIES—Effective workers can productively use:

- **Resources**—allocating time, money, materials, space, and staff;
- **Interpersonal Skills**—working on teams, teaching others, serving customers, leading, negotiating, and working well with people from culturally diverse backgrounds;
- **Information**—acquiring and evaluating data, organizing and maintaining files, interpreting and communicating, and using computers to process information;
- **Systems**—understanding social, organizational, and technological systems; monitoring and correcting performance; and designing or improving systems;
- **Technology**—selecting equipment and tools, applying technology to specific tasks, and maintaining and troubleshooting technologies.

THE FOUNDATION —Competent workers need:

- **Basic Skills**—reading, writing, arithmetic and mathematics, speaking, and listening;
 - **Thinking Skills**—thinking creatively, making decisions, solving problems, seeing things in the mind's eye, knowing how to learn, and reasoning;
 - **Personal Qualities**—individual responsibility, self-esteem, sociability, self-management, and integrity.
-

Source: Secretary's Commission on Achieving Necessary Skills, 1991

The most difficult barriers to overcome are the beliefs, attitudes, and traditions of an educational system that organizes the high school curriculum into different levels of instruction and separates students into the college-bound bright ones and "the others." The typical educational system disconnects academic learning from practical applications of that learning. It promotes high expectations for some students and very low expectations for others within the same school building. The current system is able to get some students to excel while it fails to reach many other students.

The Consortium's expectations for future workers are aligned closely with national studies that call for all high school students to be able to interpret what they read, solve work-related problems, and make wise decisions. To achieve new levels, students in general and vocational studies must be able to master the same core curriculum in English, mathematics, and science that is offered to students in the college preparatory program.

Educators must look at different approaches to both academic and vocational subject matter. They must pay special attention to the variety of ways in which students learn and to curriculum approaches that motivate more students to master the basic academic concepts essential to success in the workplace. Most importantly, educators must have the answers to two basic questions students ask: "Why do I need to know this?" and "How will I use it?" Students need to see how the things they learn in school will help them during the rest of their lives.

Charting the Consortium's Success

At the outset, states and local sites in the SREB Consortium agreed to participate in a common assessment process that includes:

- Student and faculty surveys designed to capture perceptions about high school;
- Student achievement in reading, mathematics, and science as measured by the National Assessment of Educational Progress;
- Analysis of transcripts to link student achievement to the number and types of courses taken in high school;
- A follow-up survey one year after graduation to determine the status of former students and how the high school could have prepared them better.

One additional way the Consortium evaluates and assists schools is by conducting on-site visits by external teams to learn what is working and to share successful practices.

SREB does not publish "report cards" that measure one site against another. Instead, SREB provides schools with information that sparks dialogue among the staff on ways to improve the achievement of students in general and vocational studies.

The Consortium's comprehensive evaluation plan is based on data from NAEP, which measures how well vocational students are doing on broad educational goals considered important for functioning in the outside world. The Consortium's assessment objectives are:

- To determine the progress of students in vocational programs of study at Consortium schools in mathematics, reading, and science.
- To provide school personnel with a data base and technical recommendations for planning new initiatives.
- To determine the use and role of the Consortium's Key Practices in improving student performance.

The Consortium assessment plan is designed to help high school leaders and teachers:

- Understand the strengths and weaknesses of their efforts.
- Compare their progress to composite results from all sites.
- Share what they have learned with staff in other schools.

Evidence from eight original pilot sites demonstrates that high schools can succeed in raising the achievement of vocational completers to the national average in English, math, and science by focusing on the outcome and implementing Key Practices. In just two years of involvement with the SREB program, these sites closed the gap in student achievement scores by 89 percent in reading, 36 percent in mathematics, and 75 percent in science, as measured by NAEP in 1988 and 1990 (see Tables 1-3).

The SREB sites that made the greatest gains in achievement also made the most progress in blending college preparatory and vocational studies. Findings based on the first two years of the

"Vocational Completer"

The SREB-State Vocational Education Consortium defines "vocational completer" as a student who completes at least four credits in an approved vocational area and takes three mathematics and three science courses. At least two of the courses in each category should be equivalent to the college preparatory level.

TABLE 1

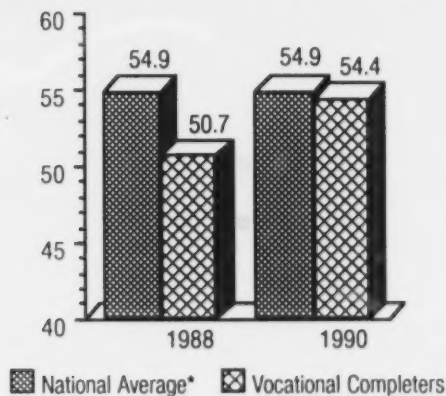
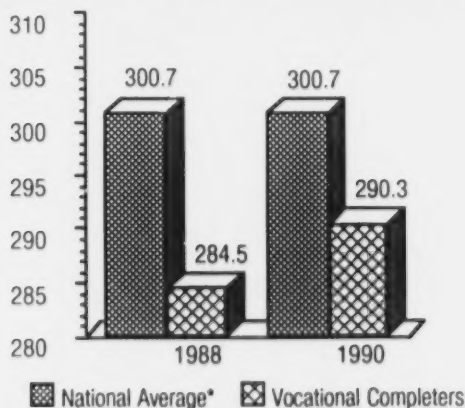
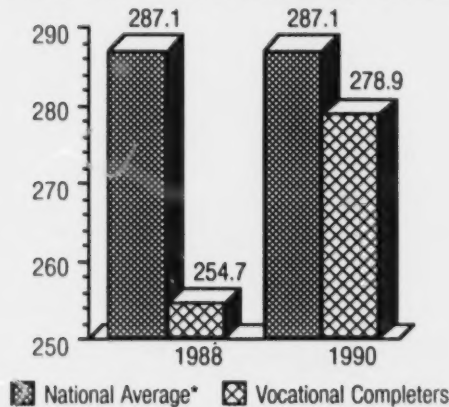
Average NAEP Reading Scores of Students Completing Vocational Programs at SREB Pilot Sites Making Greatest Gains

TABLE 2

Average NAEP Mathematics Scores of Students Completing Vocational Programs at SREB Pilot Sites Making Greatest Gains

* National values are based on public high school students in the 1986 NAEP national sample who were enrolled in a college preparatory program.

TABLE 3

Average NAEP Science Scores of Students Completing Vocational Programs at SREB Pilot Sites Making Greatest Gains

* National values are based on public high school students in the 1986 NAEP national sample who were enrolled in a college preparatory program.

program show a strong link between the quality of students' high school learning experiences and their achievement. This link is demonstrated most vividly by the eight highest achieving Consortium sites.

In early efforts, the eight SREB sites making the most improvement in student achievement varied in their emphasis on the Key Practices. For example, one site may have concentrated on incorporating academic content into vocational courses, while another site may have stressed the importance of teaching complex academic content through practical applications to life and work. When information from all eight sites is combined, the result is a composite profile of a network of high schools making

progress toward implementing the Key Practices (see Table 4). As a group, the eight sites improved because:

- They expected more from students in general and vocational programs.
- They gave more students in vocational programs access to academic content from college preparatory English, mathematics, and science courses.
- They increased the emphasis on English, mathematics, and science in vocational classrooms.
- They expanded the use of applied learning strategies in academic classrooms.
- They began the process of replacing the general education track with a Tech Prep program of study.

Information in Table 4 suggests that teachers and school leaders were awakened to the potential of these students to reach new heights.

What Is Working?

In the following chapters, you will read about practices that are helping schools effectively integrate academic and vocational education. The strategies vary from site to site, depending on the size and purpose of the school, the community surrounding it, and the types of students who attend. The SREB Consortium model has the potential to provide students with a program of study that will increase their motivation and achievement and prepare them for rewarding employment and further learning.

TABLE 4

Comparison of High School Experiences of 1988 and 1990 Vocational Completers at SREB Pilot Sites Making Greatest Gains in Achievement

Percent of Students That:

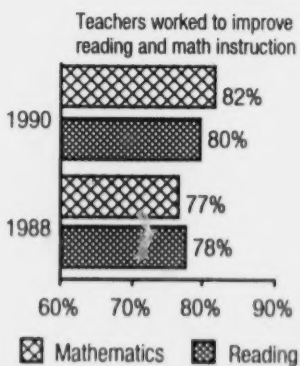
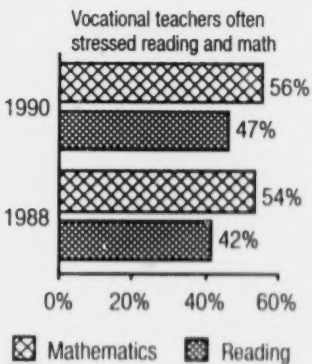
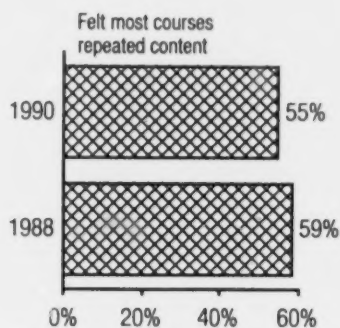
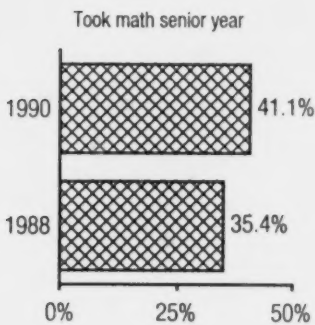
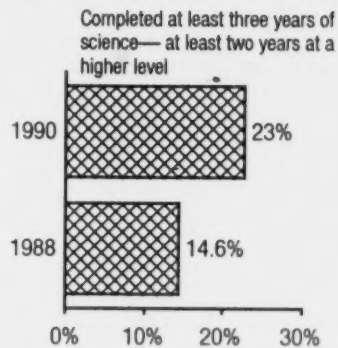
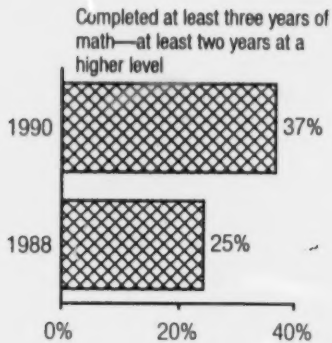
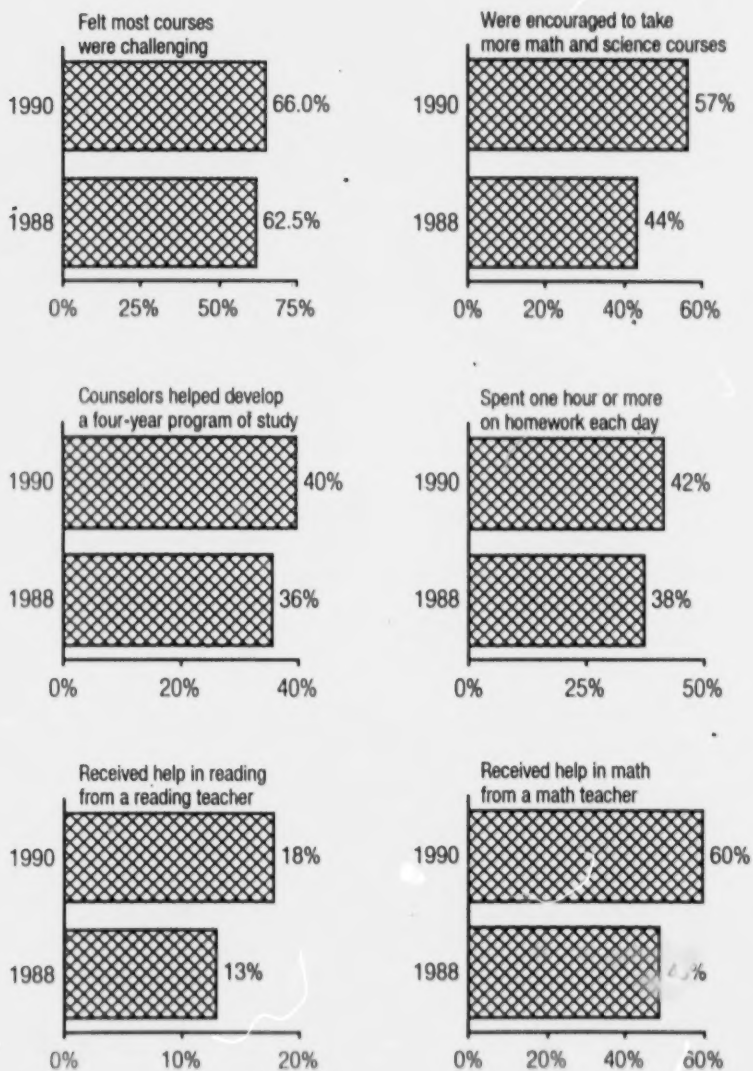


TABLE 4 (cont'd)

Comparison of High School Experiences of 1988 and 1990 Vocational Completers at SREB Pilot Sites Making Greatest Gains in Achievement

Percent of Students That:



Chapter 2

RAISING EXPECTATIONS

When a commencement speaker challenges high school seniors to "scale new heights," we must be sure every student sees the mountain and is equipped to begin the climb. Our nation cannot afford to help some students reach the top while leaving others to languish along the way.

Mike Richards tells a revealing story of his high school years. Lacking motivation, he signed up for low-level courses, like general math instead of algebra and geometry. No one recognized his potential; no one challenged him to do more. After graduation, he found a job as a ditch-digger. Luckily, Mike's story has a happy ending. He enrolled in junior college and discovered he was gifted in math. In June 1992, he graduated again—this time with an advanced graduate degree in engineering.

Like Mike Richards, many students perform below their potential. They miss out on the pleasures of learning and cripple their chances for a rewarding career. Every time this happens, our nation suffers a debilitating loss in human capacity.

Educators must establish high expectations, whether students plan to go to work, to a community college, or to a four-year college or university. All students are entitled to—and should expect—tough courses that mean something to their lives now and in the future, extra help when needed, and recognition and reward for good results.

Expectation is a framework for outstanding performance, John W. Gardner writes in *Excellence — Can We Be Equal and Excellent Too?* (Harper and Row, 1961). "If there are no expectations, there will be little high performance," he says.

Students do better when schools set high standards and provide ways and opportunities to learn. A survey of students completing vocational programs at SREB sites showed that those who have the best attitudes toward school, teachers, and coursework score higher in reading, mathematics, and science. Students with

TABLE 5
Student Attitudes Toward School, Teachers, and Coursework
and Corresponding Average Scores

National Assessment of Educational Progress Results
 for 1990 SREB Pilot Site Vocational Completers

	Percent of SREB Vocational Completers	Reading	Mathematics	Science
Amount of time spent on homework each day				
Usually none assigned	25%	51.5	287.9	261.0*
One hour or more	45%	53.5	292.5	265.8*
Most courses repeated what previously had been learned				
Agree	58%	52.1	289.0	263.7
Disagree	42%	53.9	292.0	268.7
I was encouraged to take more math and science courses				
Agree	51%	54.0	294.2	272.3
Disagree	49%	51.7	286.5	259.3
Most teachers expected or encouraged me to do well				
Agree	86%	53.5	291.6	267.7
Disagree	14%	48.9	282.9	254.6
Took a math course senior year				
Yes	47%	53.1	294.4	268.6
No	53%	52.7	287.0	263.6
Took a science course senior year				
Yes	28%	53.8	295.0	272.2
No	72%	52.5	288.7	263.5

* Unless marked by an (*), the difference in scores is statistically significant.

the highest average scores in a 1990 assessment said they spent an hour or more daily on homework, had course content that was not repetitive, were encouraged to take more mathematics and science, had teachers who expected them to excel, and took a mathematics or science course in senior year (see Table 5).

The expectations a school has for its students can make the difference between high and low achievement (see Table 6). One improving SREB site demonstrated that it is possible to raise expectations substantially in only two years (see Table 7). The percentage of students taking a mathematics course in senior year more than doubled, from 24 to 59 percent, while other improvements ranged from 3 to 14 percent.

The SREB Consortium is based on the belief that the integration of vocational and college preparatory studies creates new and challenging ways for many students to acquire essential competencies they were denied in the past.

TABLE 6**Comparison of Student Responses to Questions About Expectations
at a High-Achieving and a Low-Achieving School**

National Assessment of Educational Progress Results
for 1990 Vocational Completers at Two SREB Pilot Sites

	HIGH-ACHIEVING HIGH SCHOOL	LOW-ACHIEVING HIGH SCHOOL
One or more hours of homework	52%	40%
Encouraged to take more math/science	76%	65%
Took mathematics senior year	64%	10%
Took science senior year	19%	7%

Note: Students from the high-achieving high school scored in the upper quartile among 38 SREB pilot sites in reading, mathematics, and science, while students from the low-achieving high school scored in the lowest quartile. The two sites are comparable in size, school organization, and socioeconomic background of students tested.

TABLE 7

**Comparison of Student Responses to Questions About Expectations
at an SREB Pilot Site Making Statistically Significant Improvement
in Reading, Mathematics, and Science**

National Assessment of Educational Progress Results
for 1988 and 1990 Vocational Completers at a Single Site

	1988	1990
One or more hours of homework	50%	53%
Encouraged to take more math/science	41%	55%
Took mathematics senior year	84%	92%
Took science senior year	24%	59%

Certainly, the answer to higher achievement is not found in simply increasing the number of courses needed for graduation. Requiring students to take additional low-level English, mathematics, and science courses is virtually meaningless unless the courses contain rigor, substance, and relevance.

In raising expectations, the SREB Consortium advocates a return to the old-fashioned doctrine that hard work is the way to succeed—that knowledge, achievement, and expertise are due in large part to individual effort rather than family or socioeconomic background. Success in many cases is determined by whether a school is able to inspire students to roll up their sleeves and make the most of their education.

Every student brings abilities and experiences to the classroom. Educators must respect the potential of these students and care enough to relate classroom learning to their lives. Teachers must help students acquire the knowledge and skills to take them wherever they want to go in life.

A strategy known as "acceleration" borrows an approach that has been successful with gifted students and applies it to educating students enrolled in general and vocational programs.

Henry M. Levin, director of the Accelerated Schools Program at Stanford University, lists these characteristics of acceleration:

- High expectations on the part of teachers, parents, and students;
- Target dates by which students are expected to meet particular educational requirements;
- Stimulating instructional programs;
- Planning by educational staff members who offer the programs;
- Use of all community resources, including parents, senior citizens, and social agencies.

Like Levin, the SREB Consortium decries the fact that many high schools persist in allowing students to enroll in low-level vocational and academic courses that keep students occupied but do little or nothing to improve their knowledge and skills. SREB school site visits and interviews with graduating seniors confirm that students want to be challenged. When students in vocational programs are asked to identify a course with the highest expectations, they name an academic or vocational course taught like an honors class. In these classes, students are expected to meet deadlines and are held accountable for unsatisfactory work. Because they are actively involved in learning complex materials, they view the classes as interesting and challenging.

Teachers are a vital component in raising students' expectations. By making connections between school and the real world, they can help students appreciate the value of a good high school education. The SREB Consortium urges teachers to help students understand what constitutes a "quality product" in a term paper or a vocational project. As students discover how to evaluate their own work, they are motivated to do even better.

Arnold Webb of Research for Better Schools, Inc., in a report titled *Building Commitment Among Students and Teachers for Higher Achievement*, identifies five factors for raising expectations. The efforts of many SREB pilot sites are based on his beliefs:

Relevance—Whether school activities have meaning. Students will be much more committed to achievement if they see a connection between what they are expected to do in school and their lives now and in the future.

Respect—Students want to be treated fairly by adults and the school; teachers look for respect from administrators and colleagues. Students will have greater commitment to higher achievement if they believe the school thinks they are capable and worthy of more advanced study.

Support—Administrative actions as well as attractive buildings, appropriate materials, and staff development. Teachers and students will be more committed to higher achievement if they believe they have the support of the principal, the superintendent, and the school board.

Instruction—Administrators make instruction and achievement a priority for students and teachers. Linking school experiences to student outcomes in reading, mathematics, and science will provide the information needed by teachers and principals to change the curriculum and instructional standards and methods.

Influence—The extent of teacher involvement in decision-making. Vocational and academic teachers must share a common purpose to prepare students for continued learning in employment and postsecondary education. They must also be able to participate in revising the curriculum and the instructional process to ensure commitment for higher achievement.

"Student attitudes and behaviors are significantly influenced by their perceptions of various aspects of teacher commitment," Dr. Webb states.

Respect, relevance, and acceleration give students reasons to stay in school. They contribute to an environment where students "belong" and receive the recognition they deserve.

Motivating Students To Do More

Many students coast through high school, following the easiest route. They don't have high aspirations for themselves, and their parents and teachers don't expect much of them either. These students are living a self-fulfilling prophecy.

"The degree of motivation an individual possesses at a given time is very much affected by what is expected (or demanded) of him," John Gardner writes in *Excellence*.

The importance of high expectations is evident at SREB pilot sites where students who completed vocational programs in 1990

topped the mathematics performance of 1988 vocational program graduates by a substantial margin. At the pilot sites at High Plains, Oklahoma, and Rockbridge, Virginia, teachers and school administrators encouraged students pursuing a vocational major to enroll in a college preparatory-level mathematics course their senior year. The percent who enrolled at High Plains more than doubled—from 24 percent in 1988 to 59 percent in 1990. The increase at Rockbridge was almost double—from 27 percent in 1988 to 53 percent in 1990.

The single track English curriculum at the Muscle Shoals, Alabama pilot site places heavy emphasis on reading and writing by all students. After male trade and technical students moved through the curriculum, their achievement scores increased in the two years between 1988 and 1990. Muscle Shoals is the only SREB site where male trade and technical students exceed the Consortium reading goal.

When high school courses do not make a connection between what students do in class and what they plan to do in the future, students become bored and unmotivated. More than two-thirds of students in general and vocational programs at SREB Consortium sites in 1988 said their courses were "boring." This reality poses a major challenge for academic and vocational teachers, who must find ways to involve students in classroom activities. Teachers need to create interesting assignments that engage students in learning. They need to give students opportunities to use high-level language arts, mathematics, and science knowledge to solve real problems and perform real tasks. In short, teachers need to shift from simply dispensing information and assigning routine tasks to managing the overall learning process.

The SREB Consortium advocates a mixture of rigorous academic and vocational studies based on student participation in meaningful learning activities. The Consortium sends the message that low-quality work on low-level content is not acceptable. Students must be expected to master high-quality work.

In many ways, our high schools are like auto makers who operate in the red because they produce low-quality cars that drivers are unwilling to buy. Many American high schools continue to offer instruction that falls short of world-class standards while allowing students to do just enough work to get by. When auto manufacturers make cars that people will buy, their profits rise. When high schools upgrade their curriculum and inspire students to work harder, performance improves.

The Consortium has found that students enrolled in general and vocational programs are motivated to do more if they see a positive link between advanced academic studies and opportunities for employment. Students who want to be dental technicians, bank employees, or mechanics are more apt to enroll in challenging mathematics, science, and communication courses and master those skills if the knowledge will help them on the job.

Vocational students at SREB pilot sites who think it is important to know mathematics in order to get and keep a good job have higher average mathematics scores than those who fail to see the importance (see Table 8).

In 1988-89, the Fairdale High School pilot site in Louisville, Kentucky, gave sophomore students in a general program of study with a vocational major an opportunity to enroll in an applied mathematics course. Sixty students volunteered for the course, which was designed to teach algebra and geometry concepts through practical applications and to show the value of mathematics in a variety of skilled and technical occupations. The students were so "turned on" to math that 79.5 percent of them enrolled in Algebra II as juniors. When students took the NAEP math test at the end of the year, the juniors who had enrolled in Applied Math and Algebra II achieved the SREB math goal. Seniors completing a vocational major scored in the lowest quartile of SREB sites on the test. Only 27.9 percent had taken Algebra II; the others had chosen math courses from the general track.

The curriculum for students in general and vocational programs of study in many high schools is like a "greenhouse" that shields young people from the realities of life and work. Students think they are ready for the real world, only to discover that they are not. In a national study designed to measure how employers and high school graduates assess the preparation of high school students, the new workers and their bosses were worlds apart. An average of 70 percent of recent high school graduates believed they had job-related skills in mathematics, problem solving, and ability to understand written and verbal instructions. Only an average of 30 percent of employers shared this belief. (The survey was conducted by Harris Education Research Center for the Committee for Economic Development.)

Many students who initially declare themselves non-college bound are encouraged and inspired to consider further schooling when high schools combine college preparatory and vocational studies. At the eight SREB pilot sites making the greatest gains in

TABLE 8

**Student Attitudes Toward Usefulness of Mathematics Courses
and Corresponding Average Mathematics Achievement Scores**

National Assessment of Educational Progress Results
for 1990 SREB Pilot Site Vocational Completers

	PERCENT	AVERAGE MATH SCORES
I feel most math has practical use.		
Strongly Agree	11.3%	296.2
Agree	66.5%	291.6
Undecided	13.2%	282.7
Disagree	7.6%	289.4
Strongly Disagree	1.4%	279.6
Will your career require use of math skills?		
Yes	60.9%	294.1
No	22.5%	285.8
Undecided	16.7%	285.3*
I feel it is important to know algebra and geometry to get a good job.		
Strongly Agree	12.2%	294.8
Agree	39.4%	291.8
Undecided	20.4%	290.3*
Disagree	22.4%	289.4
Strongly Disagree	5.5%	281.0
I feel it is important to know arithmetic to get a good job.		
Strongly Agree	24.5%	298.1
Agree	54.3%	291.2
Undecided	11.4%	282.4
Disagree	7.2%	281.2*
Strongly Disagree	2.6%	275.1

* Unless marked by an (*), the difference in scores is statistically significant.

achievement and the most progress in integrating academic and vocational education, 54 percent of students completing vocational programs of study in 1990 planned to continue their studies after high school, compared to 39 percent in 1988.

SREB sites conduct followup studies to determine how many graduates actually continue their education. Trigg County High School in Cadiz, Kentucky, found that 67.8 percent of the Class of 1990 attended a college or vocational school, an increase of 13.8 percent over 1988. Jonesboro Area Vocational-Technical High School in Arkansas learned that 40.7 percent of 1990 graduates enrolled in some type of postsecondary institution, compared to 35 percent in 1988.

Vocational and academic teachers at SREB sites motivate students by working and planning cooperatively to create stimulating learning experiences. Increasingly, academic teachers enlist the help of vocational teachers in designing applied learning strategies to give mathematics, science, and communication more relevance to jobs and careers. Cooperative learning is an applied learning method that gives students a sense of responsibility to a group and demonstrates the importance of teamwork in getting a job done. (Applied learning will be discussed in detail in Chapter 3.)

The SREB Consortium's concept of a Tech Prep program of study, with rigorous applied academic courses and meaningful vocational courses, is designed to inspire and challenge students as it prepares them for responsibility in the future. The Consortium sees a Tech Prep graduate as a student who performs at the national level in reading, mathematics, and science, and is ready for next-step learning.

In emphasizing high standards and "whole school" change, the SREB Consortium acknowledges that teachers will need assistance. High schools will need to provide staff development, planning time, new instructional materials, and constant encouragement.

Valerie Truesdale, former principal of Swansea High School in South Carolina, exemplifies school administrators who appreciate and publicly acknowledge the efforts of their teachers in raising expectations. She views teachers as "experts" who know best how to improve the school climate and student achievement.

Dr. Truesdale served as a "cheerleader" who praised creative solutions and honored teachers for outstanding lesson plans. She

sought and created opportunities for teachers to obtain staff development and encouraged them to learn more about each other, both in the classroom and outside of school. "We sent one car to meetings, instead of having each teacher drive, so the group would have more time to talk and plan," she said.

To give the faculty more joint planning time, Dr. Truesdale relieved them of lunchroom duties and created a small private dining room where teachers could meet uninterrupted for 45 minutes a day. Dr. Truesdale, her assistant principal, and the athletic coaches handled the student lunchroom assignment while the teachers met.

Replacing Low-Level Courses with Challenging, High-Level Courses

Many high schools expect far too little of students who choose general and vocational programs of study. Results from SREB pilot sites demonstrate clearly that most students in general and vocational studies can master essential college preparatory content if they are encouraged to take high-level courses in a planned program of study. This is particularly true when the program combines vocational courses that emphasize academic skills with academic courses that relate to a student's experiences and plans for the future.

Schools that have made the most progress in raising expectations have replaced general mathematics, general science, and low-level English with courses that contain rigor and relevance to work and further study. In some Consortium schools, all students study algebra and geometry and take two laboratory science courses from the college preparatory curriculum. In those schools and others, there is a common English curriculum.

The mathematics department is where schools have made the greatest number of changes. Many Consortium sites have eliminated general, business, and consumer mathematics, and some have done away with pre-algebra as well.

One improving Consortium site moved courageously forward a few years ago to raise expectations by doing away with low-level mathematics courses. Using applied learning strategies, the site introduced courses usually reserved for college preparatory students. From 1987-88 to 1991-92, the school added calculus, tripled the number of second-year algebra courses, and more

than doubled the number of geometry courses. While these changes were happening, the school dropped consumer and general mathematics and cut the number of pre-algebra courses almost in half. During the 1991-92 school year, this site offered 34 sections of mathematics compared to 26 sections in 1987-88. Only nine percent of the sections were below Algebra I, compared to 35 percent in 1987-88 (see Table 9).

TABLE 9

**Comparison of the Number of Sections
of Different Mathematics Courses Offered in 1987-88 and 1991-92
at an SREB Pilot Site Making Significant Improvement in Mathematics
Achievement Among Vocational Completers**

MATHEMATICS COURSE	NUMBER OF SECTIONS OFFERED	
	1987-88	1991-92
Calculus AP	1	1
Calculus	0	2
Algebra III	0	1
Algebra II	2	7
Algebra/Trigonometry	2	2
Geometry	4	9
Algebra I	7	7
Technical Math	0	2
Pre-Algebra	5	3
Consumer Math	1	0
General Math	4	0
TOTAL	26	34

Heightened expectations at the improving site are reflected in student scores on National Assessment of Educational Progress reading and math tests. Students completing vocational majors in 1990 had higher scores than students in 1988 (see Table 10).

Four years ago, the improving site entered a period of intensive staff development accompanied by goal-setting and action-planning aimed at making the school more effective. Academic and vocational teachers—who participated in training through the State Department of Education's Lighthouse Project, SREB staff development conferences, and other opportunities—began to collaborate on a plan to improve the educational experience for all students. Regardless of turf, the teachers met regularly for most of the school year to discuss common problems and strategies.

"Once we agreed there were things we could do to benefit the kids, the project really took off," the principal said.

In the spring of 1988, a faculty committee issued recommendations for raising expectations: increase graduation requirements, eliminate the general track, add more college preparatory level courses, and introduce a number of applied academic courses. Most changes went into effect the following school year.

TABLE 10

Comparison of Average Reading and Mathematics Scores of Vocational Completers at an Improving SREB Pilot Site

National Assessment of Educational Progress Results
for 1988 and 1990 SREB Pilot Site Vocational Completers at a Single Site

	AVERAGE SCORES	
	Reading	Mathematics
1990 Completers	54.8	295.9
1988 Completers	51.5	289.1

Note: The difference in scores is statistically significant.

"You can't wait for the legislature to mandate changes like this," the principal said. "When you know something is needed, you can't just sit still."

The committee developed characteristics of a good school, earmarking the following for immediate attention:

- Develop maximum reading and writing skills needed in today's technological society;
- Assist passive students to become active learners;
- Give recognition and rewards to students for academic attainment.

The school earned the support of the school board, parents, and the community by basing the changes on solid educational research and explaining the positive effects of a school-wide effort to help students become more academically competitive. Any opposition was diffused in advance by announcing plans for the upcoming school year at parent meetings and through the local newspaper.

Recognizing that you cannot expect all students to jump effortlessly to a higher level of achievement, the school developed two plans to help students with academic problems. The first is a written plan of activities designed to correct a student's lagging academic performance. The agreement is signed by the teacher, the student, and a parent. If a student is failing four or more classes, the Cooperative Intervention of the Passive Student (CIPS) plan is used. Teachers, the school counselor, and the student's parents meet to devise ways to help the student succeed.

This school's winning attitude can be attributed to newly found cooperation among teachers, the principal observed. "We fought vocational versus academic in the trenches," he said. "But once our teachers got to know each other and understand what each other was teaching, they began to work as a team to make things happen for all students."

The school increased efforts to "challenge and encourage the average kid," the principal said. The difference is reflected in how students completing vocational majors respond to selected indicators. Many more students in 1990 than in 1988 said they experienced high-level mathematics and science (see Table 11).

TABLE 11

**Comparison of Percentages of 1988 and 1990
Vocational Completers at an Improving SREB Pilot Site
Reporting Experience in Mathematics and Science Courses**

STUDENTS REPORTED:	1988	1990
Taking a math class senior year	24%	59%
Completing three years of math	61%	85%
Completing three years of science	30%	44%
Completing applied technical math	0%	16%
Completing first-year algebra	67%	83%
Completing second-year algebra	36%	56%
Completing geometry	33%	60%
Completing chemistry	24%	30%

Note: 1990 vocational completers from this SREB pilot site made statistically significant gains over 1988 vocational completers in reading, mathematics, and science achievement.

Comanche High School in Red River, Oklahoma has substantially upgraded its curriculum, benefiting students as a result. American College Testing (ACT) scores of students who graduate from Comanche but do not complete the college prep curriculum have risen steadily, from 16.8 in 1986-87 to 19 in 1990-91.

The school made major changes designed to strengthen students' mathematics and science skills. General math was eliminated from the curriculum, pre-algebra was moved to the middle school level, and business math no longer counted toward high school graduation. Applied Mathematics was added to the curriculum in 1988. Every freshman takes the hands-on Applied Physical Science course that replaced General Science, and upperclassmen enroll in Applied Biology I rather than the biology course taught in the past.

The number of sections of math, science, and English at or above the college preparatory level increased from 26 in 1988-89 to 46 in 1991-92. Meanwhile, the number of sections below the college preparatory level decreased from nine to two. The Class of 1994 will need three credits in math and three in science for a high school diploma. This is an increase of one credit in each subject.

While the school was making these changes, the dropout and course failure rates declined. During the 1986-87, 1987-88, and 1988-89 school years, the average dropout rate was 7.7 percent; during 1989-90 and 1990-91, the rate averaged 6 percent. For the 1987-88 and 1988-89 school years, the number of students failing one or more courses averaged 15 percent; the failure rate dropped to 13 percent for the 1989-90 and 1990-91 school years.

"The single most important change at Comanche High School is in attitude," Principal Chris Stickney said. "Teachers are more aware of their roles as educators and are focusing more attention on raising expectations and increasing achievement. Students and teachers have a greater feeling of success."

Swain County High School in Bryson City, North Carolina is another Consortium site that reduced the number of sections of English, mathematics, and science offered below the college preparatory level. The total was 18 in 1991-92, down from 28 in 1988-89. Average scores in reading, mathematics, and science increased between 1988 and 1991, and the dropout rate declined from 6.7 percent in 1989-90 to 2.6 percent in 1990-91, even though more students took algebra, geometry, chemistry, and physics.

Eliminating Tracking

Views differ on the advisability of placing students in tracks or sequences based on ability, teacher recommendations, and/or past performance. Some researchers cite evidence that tracking benefits certain students; other researchers produce conflicting findings.

Critics of tracking say schools that assign students to low-level courses perpetuate the belief that some students lack the ability to do mainstream schoolwork. Students suffer diminished self-esteem that prevents them from attempting high-level courses, critics claim.

The SREB Consortium's concern is with the practice of teaching different academic content to different students within the same school. The Consortium believes all students should receive the essentials of the college preparatory curriculum; the difference should be in *how* a course is taught, not *what* is taught.

SREB's network of high schools seeks to maintain high standards while varying the ways that students are allowed to achieve them. Phillip C. Schlechty, author of *Schools for the 21st Century* (Jossey-Bass Publishers, 1990) and president of the Center for Leadership in School Reform in Louisville, Kentucky, believes schools must be flexible. He recommends taking a fresh look at grouping students, including inventing knowledge "products" that teams of students can produce. "Band concerts and class plays are products that students cooperate to produce," Schlechty said. "Knowledge products allow students to work together on a meaningful project that gives them a feeling of pride and accomplishment while they learn."

Some high schools have "over-tracked" to the point of maintaining as many as six distinct levels. When students fail to achieve in the lowest level, an even lower track is created. With so many levels of instruction, students quickly figure out how to finish high school with the least amount of effort.

The Consortium encourages high schools to examine their instructional methods and adopt approaches that accelerate rather than impede student academic and vocational learning.

Some of SREB's highest achieving pilot sites have eliminated tracking in one or more subject areas. Randolph County High School and Vocational-Technical Center in West Virginia dropped low-level English, general mathematics, and basic biology, and moved students into more advanced courses without significantly affecting failure rates. The dropout rate continued to decline, from a pre-Consortium level of 23 percent in 1986-87 to 12.6 percent in 1990-91.

"My attitude toward the vocational students changed completely," one Randolph County mathematics teacher said. "I tolerated them in the past, but I focused my attention on college-bound students. When I saw that vocational students were capable of mastering higher level math, I realized that low-level courses and expectations are totally inadequate."

Muscle Shoals High School in northwest Alabama, Trigg County High School in western Kentucky, and York High School

in Yorktown, Virginia are three Consortium sites that have made real progress in teaching the same English curriculum to all students. Muscle Shoals and Trigg County are moving toward a common curriculum in mathematics and science as well.

What prompted these schools to revamp the English curriculum? In all three cases, school and system leaders came to realize that students were not being well-served. One superintendent said, "The event that drove us to action was the complaint of a local employer who hired several of our graduates. He found them unable to speak or write clearly or understand what they read." On investigating, the superintendent learned that graduates completed the "feel good" curriculum—an anemic array of courses in which the students made good grades and had the impression they were learning. Based on what he discovered, the superintendent began a series of meetings with the English faculty and principal to discuss ways to upgrade the curriculum. Eventually, the group decided to abolish tracking, beginning in the English department.

At all three sites, teachers and school leaders found the tracking system to be a failure. Teachers of the low-level courses felt less was expected of them, and they, in turn, expected less from their students.

The sites followed similar paths in developing a common English curriculum. One site used a staff retreat during which English teachers moderated groups of faculty members as they brainstormed ideas for curriculum revision. These ideas and others were discussed in subsequent meetings of the English department and the administration. Working individually, English teachers produced a variety of "mini-curricula," which the chairman organized and brought back to the department for final approval.

Several guiding principles have emerged from the work of teachers and administrators:

- ✓ Use the same textbooks for all English students at each grade level. As one English teacher said, "When students in vocational programs saw they had the same books as the college preparatory students, their attitude changed. They started carrying their books home, and we heard comments that the new books were more interesting than the old ones."
- ✓ Provide students enrolled in general and vocational programs with the same demanding English courses that college preparatory students take.

- ✓ Build the English curriculum around a strong literature component that exposes all students to a common reading core.
- ✓ Emphasize writing as a central part of the English curriculum. Writing is 50 percent of the English coursework at one school. At another, English students in grades 9 through 12 must write a formal paper each week. A 10th grade English teacher at one site requires students to write a paragraph every day for a full semester. "When students finish my class, they know how to write a paragraph correctly," she says.
- ✓ Retain the high standards previously reserved for college preparatory English. To do this successfully, the school and teachers need to assist students who have been taking low-level English. Sometimes teachers show a film to give students needed background on a difficult literature assignment. One site uses upper grade honor students to tutor students in lower grades. Another site has added a resource period for students who have trouble mastering the new uniform English curriculum.

Students who formerly would have been in the middle and lower English sequences are stretching, and sometimes straining. "Some students have to struggle," observed Florence Rush of York High School, "but we must allow these students the opportunity to achieve at a higher level."

Superintendent Martha Livingston of Muscle Shoals says results from offering the same English to all students in one grade have been positive, especially in improving the reading level of male trade and technical students. "Students from the lower levels want to do well in a regular class, and students at the top are not bored or held back," she says.

Extra Help for Students

Students who enroll in higher level courses may need extra assistance outside the classroom. Schools that raise the standards for students in general and vocational programs must be willing to help.

The 1990 publication *High Schools with Character* explores the key features of private and special purpose public schools, which other high schools can implement to benefit the vast ma-

jority of students. The underlying feature is a clear concentration on student outcomes—placing how students learn and behave before all other considerations. Another characteristic is “a strong commitment to parenting”—creating a school environment that encourages teachers to take a personal interest in students’ well-being. Teachers in private and special purpose public schools assume a watchful role. They monitor students’ progress and provide tutors, supervised study halls, and other assistance to students who need a boost.

The eight SREB pilot site schools making the greatest gains in achievement have programs to give students extra help. Assistance at these schools takes many forms:

Tutoring Program—Teachers are available to tutor individuals or groups of students before, during, and after school and on Saturdays. Often, these teachers are paid an hourly rate based on their salary. Students and teachers report that tutoring benefits high-achieving students as well as those who are struggling. Therefore, no stigma is attached. Students take the initiative to schedule tutoring, or a teacher may suggest it. At one school, an algebra teacher who also coaches basketball conducts a three-hour tutoring session one night a week for student athletes who need help.

Teacher Help Program—Schools set aside certain times for teachers to help students. At pilot sites making gains in achievement, vocational completers in 1990 perceived that their teachers were reaching out to help them meet their learning goals. The change in student perceptions was greatest at the Rockbridge, Virginia site. In 1988 only 53 percent of students reported that their teachers were working to improve their reading skills. The percentage almost doubled in 1990, when 92 percent of students reported good teacher support for reading. Similar changes took place in writing and mathematics.

Resource Center—Several vocational schools have resource centers with computers and software to enable students to work on academic deficiencies. These labs are used most frequently for improving reading and mathematics skills. A center may be staffed by a resource teacher who provides individualized directed learning for students with low ability and lack of motivation.

Crisis Intervention Program—This is a program for students who are failing because they do not complete their work or perform well on examinations. The students are given a period of time in which to bring up their grades. If that effort is unsuccessful

ful, a team from the school works with the students and their families to develop a formal, workable plan for improvement. Progress is monitored, and meetings with each student are scheduled regularly.

Teacher Mentoring of At-Risk Students—In a program at Jonesboro Area Vocational-Technical High School in Arkansas, every teacher and administrator served as a mentor to three or four students each year. These were not students they taught at the time. The students were selected on the basis of grade point average, recommendations of their vocational instructors, and standard tests to measure their risk of dropping out of school. The students didn't know they had mentors, but noticed the increased interest teachers took in their school performance and personal well-being. Students turned to teachers for extra help during morning planning time, lunch and other breaks, and the afternoon. When an at-risk student was absent from school for more than a few days, a teacher/mentor and a guidance counselor coordinated a phone call or visit to the student. There were no dropouts among the 50 students with mentors.

Employer Mentoring of At-Risk Students—Cathy Broadway coordinates a community mentoring program for the Gulfport, Mississippi school district. Volunteers from banks, utilities, a TV station, and other local companies spend time with students assigned to them for extra help with schoolwork. The mentoring may take place at school or at the mentor's office. One businessman comes to the school during study hall twice a week to assist a student with mathematics. Other students walk to their mentors' offices after school. Volunteers make a three-month commitment, but some have enjoyed mentoring so much that they have remained throughout the program's four-year history. Training and orientation are provided to new mentors on all aspects of the program, including tips on building students' self-esteem. "Many students are from low socioeconomic backgrounds," Ms. Broadway says. "If our program can show them someone really cares whether they do well in school, we are a success."

Homework

Homework is essential in upgrading students' academic performance. Vocational completers at SREB sites who spent an hour or more a day on homework had higher average scores than SREB completers who had no daily homework assignments (see Table 5.) SREB pilot sites making the greatest gains in average

achievement scores of vocational completers between 1988 and 1990 were more successful than other sites in getting students to spend more time on learning tasks or units of instruction.

The SREB Consortium believes there should be regular homework assignments in all classes—vocational as well as academic—to engage a student for an hour or more each day. SREB's recommended homework policy calls for frequent, worthwhile assignments and regular review of work.

Vocational and academic teachers who use imagination and knowledge of real-world occupations can improve classroom learning through meaningful homework assignments. Here are examples from SREB pilot sites:

- ✓ An organization for vocational majors motivates members to prepare for competition in local, state, and national events. Suggested activities include writing and delivering a speech, reporting on an entrepreneurial project, preparing for job interviews, or mastering printed technical materials before entering a skill event.
- ✓ A vocational teacher assigns a group of students to study and discuss technical information from a vocational field and teach classmates what they need to know. As one student said, "When you get this kind of homework assignment, you do it. You don't want to be the one to give wrong information to the rest of the class."
- ✓ Academic and vocational teachers work together to assign homework that cuts across two instructional fields and may take students weeks or even months to complete. Teachers serve as coaches and advisors. The assignment may include a major research paper for English on a topic from the student's vocational field. At one school, mathematics and building construction teachers ask students to design and figure the cost of a "dream home."
- ✓ Vocational teachers often make homework assignments that require students to combine language arts and mathematics in learning more about their fields of study. The following are examples:
 - Computer students fill a scrapbook with bills, letters, and other materials mailed by businesses to people's homes. Students examine the correspondence to identify modern computer techniques.

- Students list home appliances operated by small computer.
- Students in an office occupations field interview local experts on job-related topics. The interviews become the basis of research papers assigned as homework.
- Students in a commercial foods class keep a weekly diary of what they eat and calculate the calories and cholesterol. They use mathematics to cut a favorite family recipe in half or double it.
- ✓ One electronics teacher operates the classroom like a real work setting to motivate students to read the textbook outside of class. "If you don't stay up-to-date on technical materials in your job or career, you will find it hard to move ahead," he warns. Students must pass a written technical examination on each section of the course. They discover that the way to move to a higher level is to spend additional time reading and studying in their field.
- ✓ Some schools have after-school homework settings for students who need a quiet place to study.
- ✓ Schools give parents materials to help students with homework, establish a homework "hot line," and enlist "buddies" to help fellow students with assignments.

Vocational Education's Role in Raising Expectations

Vocational education is highly qualified to raise expectations by helping students see the relationship between future employment and advanced academic competencies in language arts, mathematics, and science. Vocational classrooms and labs are rich with opportunities to use cognitive learning—as opposed to physical training—in solving problems and completing tasks.

SREB pilot sites use a variety of ways to raise expectations by increasing the amount of academic content in vocational classes:

Introduce New Courses—Diversified Technology is a new vocational course combining academic and vocational competencies in an integrated curriculum. The course was developed in Mississippi and is taught at two SREB pilot sites there. Preparing students to continue their education and find good jobs in a modern high tech world, the curriculum covers mathematics, applied

physics, mechanics, computers, graphics, and robotics. Students work together on a variety of laboratory projects designed to foster academic and technical ability and understanding. With knowledge, experience, and confidence gained from the course, most Diversified Technology students seek further schooling at a local community college.

Strengthen Academic Content in Existing Vocational Courses—Vocational teachers at Cedartown Comprehensive High School in Polk County, Georgia, expect students to sharpen their related reading, writing, and mathematics skills while completing assignments in vocational labs. This contributes to increased achievement in reading and mathematics. The average reading scores for 1990 vocational completers exceeded the SREB Consortium goal; mathematics scores were more than eight points higher than the Consortium average. Cedartown is a site where 68 percent of students said vocational teachers often stressed reading, compared to 48 percent at other sites, and where 76 percent said vocational teachers often stressed mathematics, compared to 56 percent at other sites.

Revise Existing Vocational Courses—The State of Tennessee has revised its 9th and 10th grade agriculture curriculum to place a strong emphasis on science. Vocational completers who took the agriscience course at one SREB site in Tennessee averaged 298.6 on the 1990 NAEP science test; in 1988, before the course was available, vocational completers at that site scored only 268.9.

Convert an Academic Course into a Vocational Course—The Trezevant Vocational Technical Center in Memphis, Tennessee created a new program to help students connect chemistry concepts to industrial applications.

Make the Content Relevant and Require the Program to Meet Industry Standards—The innovative PrintED program introduced in Georgia in 1988 is an example of a business and education partnership designed to improve vocational instruction and give students a head start on a career. High school graphics arts programs that meet PrintED certification requirements produce students with specialized learning that is equivalent to six months of on-the-job training in the printing industry. As a result, graduates are much likelier to find jobs in printing.

PrintEd was created by the Printing Industry Association of Georgia Educational Foundation in conjunction with the Georgia Department of Education. Based on two years of research into industry needs and subsequent educational requirements, the pro-

gram requires graphics arts programs to demonstrate excellence in nine standard areas of printing: purpose, administration, learning resources, program budget, student services, vocational and related academic instruction, equipment, facilities, and instructional staff.

One veteran high school graphics instructor described the benefits of PrintED: "The sequencing of academic and vocational skills is better, the problems students solve require more academic knowledge, and industry connections are stronger. Students participate more actively in class and have a positive attitude toward the school and graphics arts education."

Involving Parents and the Business Community

Students need to know that their parents and the community favor a more rigorous high school program of study. Educators must tell parents and the community what the school is doing to improve the performance of all students and ask for their enthusiastic support.

Most SREB pilot sites making substantial progress in raising expectations have launched some type of information campaign targeted to parents. Efforts may include orientation sessions, letters, news articles, and teacher contacts.

Trigg County High School in Cadiz, Kentucky, attracted more than 90 percent of parents of eighth grade students to an evening orientation and scheduling session. About 85 percent of parents participated in an annual parent-teacher conference sponsored by the local school board. The school's tactics included writing special letters to parents and placing articles in the local news media. Teachers are encouraged to communicate with parents throughout the school year. They send midterm grades and suggest extra help or tutoring when needed.

At Canton High School and Vocational-Technical Center in Mississippi, parents of students who are failing one or more classes must pick up report cards at the school. Teachers devote after-school time to meet with parents in determining what can be done to improve students' grades.

Local employers can be valuable allies in a marketing campaign to help parents and the community understand the relevance between what young people learn now and what they will be

expected to know in the future. A committee of top private employers evaluated the academic courses vocational majors were taking at one SREB site. The study confirmed that students enrolled in vocational programs of study were not equipped for the modern workplace.

A local business can donate time and money to make speeches, design and distribute brochures, conduct tours, and organize other community awareness activities about the need for well-prepared high school graduates.

Summary

Schools in the SREB Consortium are proving it is possible to raise expectations if the curriculum is relevant, students feel they are respected, and teachers and administrators work together.

Rockbridge High School in Fairfield, Virginia made significant gains in student achievement by replacing most low-level courses with ones previously reserved for traditional college-bound students. This pilot site school is proof that when you raise expectations, you can lower both the dropout rate and the course failure rate. In 1986-87 Rockbridge had a dropout rate of more than 6.5 percent of its enrollment in grades 9 through 12. In 1989-90 the rate was below 5 percent. In 1986-87 almost 10 percent of Rockbridge students failed one or more courses. The failure rate in 1989-90 was below 6 percent.

Teachers and principals at schools in the SREB Consortium are no longer willing to accept the outdated belief that poor and minority youth cannot be expected to achieve; they are discarding the notion that motivational and achievement patterns are established before students reach high school and cannot be changed.

SREB Consortium schools are devising curriculum and instructional strategies that raise expectations and enable students in general and vocational programs of study to master essential content from college preparatory English, mathematics, and science.

Chapter 3

MAKING ACADEMIC LEARNING REAL

High schools traditionally fail to relate the academic curriculum to what people do in real life. Students need to learn to think, solve problems, and use what they have learned in everyday job and career situations.

The SREB Consortium recommends "applied" learning strategies to show students how abstract ideas are used in a variety of real-life situations. Integrating college preparatory studies with vocational education gives students more options for mastering complex reading, writing, mathematics, and science concepts.

Susan F. Chipman and others (*American Educational Research Journal*, Winter 1991) found that there is no relationship between the higher level mathematics background of college students and their ability to solve problems using math in new situations. The findings lend support for increased emphasis on practical problem solving in math instruction.

Students in vocational programs of study and students in college preparatory programs are more alike in mathematics problem-solving and routine application than they are in mathematics knowledge, an SREB study shows. In comparing responses to NAEP mathematics items, SREB found that vocational completers at SREB sites in 1990 scored 10 percent lower than college preparatory students nationally on problem-solving and routine application items. Yet, vocational completers were over 14 percent below college preparatory students on percent of math knowledge items answered correctly. Why do vocational completers, who take fewer math courses and more lower-level math courses than college preparatory students, close the gap by one-third in math applications and problem-solving? It may be that some vocational courses help improve the ability of students to use their more limited math knowledge to solve problems (see Table 12).

TABLE 12

Comparison of Correct Responses By 1990 SREB Vocational Completers and College Preparatory Students Nationally on NAEP Mathematics Test Items

	SREB VOCATIONAL COMPLETERS	NATIONAL COLLEGE PREPARATORY STUDENTS
Problem Solving/Reasoning	43.7%	53.6%
Routine Application	55.5%	64.5%
Understanding/Comprehension	46.1%	57.9%
Skill	60.9%	71.8%
Knowledge	53.7%	67.8%

Source: SREB-State Vocational Education Consortium Student Assessment Results.
National values based on 1986 data.

How Students Learn

How students learn in the real world is often quite different from how they are expected to learn in school. There is no question that all students would be more adept at understanding, retaining, and using complex academic concepts if they had opportunities to use them. There are some students, in fact, who don't even try to learn if they cannot readily see a link between the information and what they are doing or hope to do in life.

Lauren B. Resnick of the Learning Research Development Center in Pittsburgh compares how students think in high school with how they think in real life. She focuses on four fundamental dimensions:

Individual thinking versus collaborative thinking—In school, students often work alone. If a student gives or receives help, it may be considered "cheating." In the workplace, teamwork is valued highly. An employee's success may be based on the ability to work cooperatively with others.

Abstract thinking versus concrete thinking—In school, students learn abstract concepts which they may never use to perform a tangible task or solve a practical problem. At work, the emphasis is on using knowledge to complete a task.

Manipulating symbols versus reasoning with symbols in a specific situation—The focus in many high school courses is on manipulating symbols and learning facts out of context. In the workplace, employees must know what symbols mean to the job at hand.

Generalizing from general learning versus generalizing from specific reasoning—High school students are taught that abstract knowledge is powerful because it can be applied in any situation. In real life, people use folklore-type "stories" to remember past events and figure out new situations. Schools emphasize the transferability of generalized knowledge by teaching knowledge in absence of its use. Yet, employers say high school graduates entering the work force are unable to use what they know to solve work-related problems.

**Integrated Academic and Vocational Studies
Can Expand Traditional In-School Learning
to Include Out-of-School Learning Options**

IN-SCHOOL LEARNING

OUT-OF-SCHOOL LEARNING
(Work, Home, Community)

Individual Learning



Cooperation

Abstract Thinking
(Pure Mentation)



Concrete Thinking—Doing, Using Tools

Symbol Manipulation
(i.e. math formulas)



Look Beyond Symbols—Reasoning
—What the Symbols Reflect

Generalizing from General
Learning to All Situations



Specific Reasoning—Concrete Reasoning
with Stories to Reasoning in Multi-Specific
Situations

Adapted from *How We Think and Learn*, The National Council on Vocational Education, July 1991.

The integration of academic and vocational education addresses the differences between how high schools teach and what workers are expected to do on the job. Once students have used academic knowledge in a vocational context, they should be encouraged to report what they have learned and explain how it can be applied to other situations. Students in vocational fields can share their experience in using academic content skills in different vocational labs.

What Is Applied Learning?

The SREB Consortium is dedicated to using applied learning strategies to give non-college preparatory students an upgraded high school education. All SREB pilot sites are using these strategies.

Applied learning combines the essential elements of the college preparatory curriculum with effective learning and problem-solving strategies in a broad technical or business field of study. The academic subject matter includes the essential concepts, facts, and procedures normally identified with college preparatory language arts, mathematics, and science courses. Students become familiar with ways to use academic knowledge to perform tasks and solve problems within a business or technical field. They are introduced to skills and procedures for reading and writing for learning, as well as techniques teachers and experts find useful for learning and using subject matter knowledge.

Teaching methods are designed to give students an opportunity to grasp the whole task or concept they are being asked to learn, relating it to their past experiences and to potential uses in the future.

Applied learning is actively student-oriented, characterized by lively classroom discussions, absorbing group projects, meaningful homework assignments, laboratory experiments, live and videotaped presentations, and other hands-on activities. The purpose of applied learning is to create an environment that actively engages students and teachers in a collaborative learning process.

The method provides a logical link between in-school and out-of-school learning and can result in academic achievement for students who have been bored or detached. Students use new knowledge to do quality work and master content that others thought they could not handle.

"This math is different," observed one student enrolled in a math class designed to teach algebra and geometry in an applied way. "Math was always a chore for me, so I would never do homework and would sleep through algebra. Now, I'm learning things that already help me in my work with my dad."

Instead of simply reading about a symbolic concept and listening as the teacher explains it on the chalkboard, students in applied learning examine the workings of a real engine or visit an actual construction site.

Gene Scovel, applied physics teacher at Buffalo High School in rural Oklahoma, introduces physics concepts by using a combine—a piece of wheat-harvesting equipment. Many students who grew up on a farm and have operated a combine "have never thought about how it works," Scovel said. The class studies the hydraulics, the diesel engine, and the electrical system. "They see the principles of physics in action in one piece of equipment," he said.

The Impact of Applied Learning

Applied learning is altering what is taught, how students are taught, what is expected of them, and how teachers relate to each other and to their students. As one high school principal said, "It's changing the way everybody teaches."

DiLynn Hayes of Comanche High School in Oklahoma introduces students to applied biology with a lab activity on the characteristics of living things. Students rotate through a number of lab stations containing objects such as a goldfish, a rock, and a radio. They examine the objects and record whether they are living or non-living and why. Then they discuss their findings with the rest of the class. "I don't introduce the biological concepts until they have worked in the lab and developed ideas of their own," Ms. Hayes says.

Students spend three days a week in the lab, working in teams that allow higher achieving students to assist students who don't learn as quickly as they do. "The students love it," Ms. Hayes says. "They enjoy coming to class, because they are actively involved in learning."

The curriculum was developed by the University of Oklahoma and public schools in Norman, Oklahoma. "I've taught tradi-

tional and applied courses, and students have a much better understanding of biology through a lab setting as opposed to memorizing facts from books and lectures," she said.

Test results for these students are higher, and they are better prepared for other science courses, Ms. Hayes said. "The applied physics teacher told me the applied biology students are three months ahead of students who have not had the course. They know how to set up labs and operate equipment."

Her advice to other teachers is, "Change your program, and use the applied teaching method. It requires more work in the beginning to prepare for classes, but it makes a world of difference in what the students learn."

The SREB Consortium is based on increasing the amount of applied learning that high school students receive. If we want students to be able to use what they learn in high school, we must give them authentic problems to solve. We must help them understand why they are learning something and how it will help them on the job, at home, and in the community.

Jerry Adair, Applied Biology/Chemistry teacher at South Cobb High School in Georgia, says applied learning "makes more sense" than conventional learning. During a nutrition unit, one of his 10th grade students helped her pregnant sister-in-law work out a healthy eating plan. "When kids share what they learn in school with family and friends, you know they understand it," he said.

Applied learning helps students see how academic and vocational fields of study interrelate. When teachers make academic learning real, they help students realize the need for math and science in a high-tech economy and in specific occupations in business, industry, health services, and agriculture. Teachers can help students prepare for a world where they will be called on regularly to apply their knowledge of science and math to increase production and create new ideas.

Applied teaching methods enable students to relate to the real world of making a living and raising a family. Students do not just read about careers; they have opportunities to practice the skills that will make them more valuable employees and citizens.

Elements of Applied Learning

1. CONTENT KNOWLEDGE

Academic Knowledge

Specific concepts, facts, and procedures drawn from college preparatory language arts, mathematics, and science curricula.

Learning and Problem-Solving

How to learn new concepts, facts, and procedures. For example, using reading and writing techniques to learn subject matter. Students are introduced to strategies used by teachers and experts in academic and vocational fields to solve problems and apply academic content to new situations.

Technical Knowledge and Skills

Technical subject matter and specific problems, procedures, and tasks for broad occupational fields of study.

2. EFFECTIVE METHODS

Build on Experiences and Potential Uses

Introduce new concepts, facts, and procedures by relating them to students' past knowledge and experiences. Relate the concepts, facts, and procedures to specific situations students are likely to encounter in the future.

Make Connections

Encourage students to verbalize and share connections between what they learn in academic and vocational classes.

Focus on the Whole Task To Be Learned

Help students visualize the whole task they are being asked to learn before they break it into smaller parts.

Use New Knowledge

Allow students to use new knowledge in the context of working through a real problem.

Reinforce Academic Knowledge

Encourage students to verbalize academic competencies they will need to solve a job-related problem or perform a task.

Cooperative Learning

Students work together to accomplish their goals in academic and vocational classes and across classes.

Joint Learning Projects

Academic and vocational teachers work together to help students learn how to use academic knowledge and competencies to accomplish a work-oriented task or product. In the spirit of traditional apprenticeships, this approach provides students with guidance and support for individual and group projects.

3. SCHOOL CLIMATE AND ORGANIZATION

Interdisciplinary Staff Strategies

The school organization promotes interdisciplinary teams of academic and vocational teachers working together to improve academic learning.

Student Schedules and Assignments

The school schedule and student assignments allow teachers to share a group of students.

Leadership

Schools encourage and reward collaboration among academic and vocational teachers, including arranging time in the schedule for them to meet and plan together.

Adapting or Developing New Applied Academic Courses

More materials are becoming available for teaching college preparatory level mathematics, science, and communications content through an applied process. Most SREB pilot sites are using materials developed by the Center for Occupational Research and Development (CORD) in Waco, Texas and the Agency for Instructional Technology (AIT) in Bloomington, Indiana as part

of a multi-million dollar curriculum effort. A national consortium of state and provincial education agencies funded the development of Principles of Technology (applied physics), Applied Mathematics, Applied Biology/Chemistry, and Applied Communication in response to a plea from business and industry for high school graduates with the ability to relate basic academic knowledge and skills to the context of the workplace.

SREB site schools are in the process of incorporating one or more applied courses into the curriculum over a period of several years. The courses include:

- ✓ **Principles of Technology** is an applied science course for students interested in technical careers or wanting to increase their understanding of the physical principles underlying modern technology. The course holds the interest of students with audiovisual presentations, texts, demonstrations, and hands-on laboratories. It is a two-year curriculum covering 14 units in applied physics: force, work, rate, resistance, energy, power, force transformers, momentum, waves and vibrations, energy convertors, transducers, radiation, optical systems, and time constants. The course also covers the mathematics needed to understand and apply the physical principles. (Developed by CORD and AIT)
- ✓ **Applied Mathematics I and II** present the math content most essential to the modern workplace, including algebra, geometry, trigonometry, statistics, and the use of computers to solve problems. Word problems require students to read and understand before they can solve a problem. Students watch videotapes, work in small groups, solve problems in the math lab, and apply math knowledge in vocational studies. The two one-year stand-alone courses include a total of 36 instructional units. (Developed by CORD)
- ✓ **Applied Biology/Chemistry** presents the scientific fundamentals of biology and chemistry that students need for careers in technology, health, agriculture/agribusiness, and home economics, using activities that relate to work and other life experiences. The course includes many laboratory activities, which are introduced by scenarios showing how people perform similar tests or experiments on the job. Units focus on natural resources; water, air, and gases; continuity of life; plant growth and reproduction; nutrition; and disease and wellness. Optional units address life processes, micro-

organisms, synthetic materials, waste and waste management, and community of life. (Developed by CORD)

- ✓ **Applied Communication I and II** (also referred to as Applied English). These courses foster reading, writing, and speaking as well as group interaction, giving and taking instructions, and conflict resolution. Applied Communication does not meet the SREB concept of college preparatory equivalency unless a school incorporates the literature and writing expectations of college preparatory English. (Developed by AIT)

Another applied course, **Materials Science Technology**, was developed by Battelle Pacific Northwest Laboratories, Richland High School, and Northwest Regional Education Laboratory. It uses the problem-solving methods of research scientists to examine the wide array of materials used in modern technology.

ChemCom, short for Chemistry in the Community, is a hands-on chemistry course developed by the American Chemical Society. Designed to teach chemistry concepts through application in industrial, agricultural, health, and other settings, ChemCom is taught at several SREB pilot sites. The course covers most of the key concepts of conventional chemistry courses while emphasizing decision-making and critical thinking rather than mere memorization of facts.

The **University of Chicago School Mathematics Project** translated recommendations from national groups of mathematics educators into an updated mathematics curriculum for grades 7 through 12. Chicago Math, wider in scope than traditional mathematics courses, emphasizes reading and problem-solving and shows how to apply each mathematical idea to real-world situations. The project recommends that all high school graduates take the first four courses—Transition Mathematics, Algebra, Geometry, and Advanced Algebra.

In some cases, applied academic courses have been or are being developed by a state or local curriculum team or individual teachers for use in one or more schools. The courses are usually in English, mathematics, or science, but the applied learning method is proving so popular that curricula for other academic courses frequently are re-written to feature applied learning techniques. The Experiential Economics course at Lake Gibson Senior High School in Lakeland, Florida is an example. Economics teacher Warren Linton, who wrote the curriculum two years ago, has combined it with information in the Capstone series of books from the Joint Council on Economic Education. In

developing the course, Linton found that he was unable to use the applied techniques from communication, mathematics, and science. "Unlike those subjects, economics is a philosophy rather than a skill," he explained.

Experiential Economics is required for all of Lake Gibson's 11th grade students. Linton introduces the topic of protectionism and international trade by dividing the class into four to six "factories" to produce "books," crude replicas the students assemble by tearing sheets of paper and stapling the "pages" together. The "factories" then become "countries," which work in pairs to negotiate an international trade agreement that will benefit both "nations."

Linton designed the curriculum so that students experience an economic concept before he explains it. He says it helps them realize, "Oh, yes. I understand. We just did that."

Applied communication students at Swansea High School in South Carolina are learning a lot and enjoying what they learn. As juniors, many students have decided they "don't do English," Instructor Sandra Jowers said. Communications for the Workplace has changed their attitude.

"We use the same literature book the college preparatory students use," Ms. Jowers noted, "but we put everything in the context of a workplace setting. When my students write essays or do a research paper, the emphasis is on short, concise writing based on critical thinking and problem-solving skills."

Creative pieces the students have written include a memo from Mark Twain to the captain of a Mississippi riverboat, a letter from Macbeth applying for the job of king, a list of Benjamin Franklin's time management techniques, and a job resume for Hester Prynne of *The Scarlet Letter*.

"Some people think there is something wrong if students enjoy class," Ms. Jowers said. On the contrary, some of the same students she taught in 9th grade are doing better than ever before. "They told me the books they had in the past were not as interesting as the college prep literature books we use now," she said. "They were bored from studying the same material, such as parts of speech, over and over again."

Communications for the Workplace combines modules from the Agency for Instructional Technology's Applied Communication course and applied activities based on literature from the

college preparatory curriculum. The course is offered in the 11th and 12th grades and counts as two English credits.

"The level of involvement is the biggest difference for the students," Ms. Jowers said. "When the students realize that what they are asked to learn is closely akin to real-life situations and that they are going to be actively involved in the learning, they become very enthusiastic.

"The course is challenging, and many students make C's in the beginning. When they see they can do the work, they go for higher grades," Ms. Jowers said. "By the end of the year, a high percentage of students makes A's.

"If you stood them side by side with college preparatory students, these students would do as well as, or sometimes even better than, the college-bound kids," Ms. Jowers said. "Through the applied method, general and vocational students become active participants in learning. If they have a problem to solve, they jump in and try to figure it out. College-bound students, who mainly read and listen to lectures in English class, may not be as primed to apply what they learn."

An experienced English teacher, Ms. Jowers volunteered to teach Communications for the Workplace and to participate in the state-level staff development and professional networking associated with it. Even though she had incorporated career awareness activities into her regular English classes for a number of years, she felt that career-bound students were capable of completing more challenging courses and that those courses should be related to their goals for the future. "We were selling students short with low-level courses," she said.

Ms. Jowers wants her students to understand and appreciate what they study. "They don't have to read every piece of literature ever written. It's more important for them to remember and to be able to use what they learn. That's what they are getting in this course," she said.

Ken Brown's 12th grade students in Applied Communication II at Lake Gibson Senior High School in Lakeland, Florida are actively involved in Shakespeare and other English literature. When they read Chaucer's *Canterbury Tales*, they write profiles of the main characters and discuss how personality is related to a person's job or career. Working with partners in a cooperative learning approach, the students write dialogue for a mock interview between the characters and a TV talk show host.

Brown alternates the standard modules from Applied Communication II with the literature components he has developed, rather than integrate them into the modules. Several years ago, Brown had students in all four of his applied communication classes work together on a project to learn *Macbeth*. In groups of three or four in each class, they consulted the dictionary and thesaurus often as they rewrote the play in modern language. The only parts that did not change were such famous lines as "Double, double, toil and trouble."

Communication students who were also taking business education entered the new version of *Macbeth* on the computer and distributed copies to all students who helped with the writing. The work has become the text for *Macbeth* in Brown's classes.

"These students don't learn iambic pentameter, but they do remember the story," Brown said. "When they read or hear about *Macbeth* in the future, they will know what it means."

Levels of Difficulty of Applied Academic Courses

Applied academic courses are designed to be more difficult than the "general" and "basic" high school courses they replace. Teachers of the applied courses testify that the courses are not only challenging but also require students to change the way they learn—from memorizing and duplicating to thinking for themselves.

- Applied Mathematics teachers at Pebblebrook High School in Cobb County, Georgia estimate that a grade of 65 in Applied Math is equivalent to a grade of 75 or 80 in general math.
- "In Principles of Technology, we teach in three weeks what it would take students a year to learn in general science," says Bill Willard of Seneca High School in South Carolina. "When I discovered that students were having difficulty with the math concepts in Principles of Technology, I began spending the first two weeks teaching the math skills they will need for the course," he said.

Introducing Applied Courses to the Curriculum

Some schools decide rather quickly that they want to introduce new applied academic courses in the upcoming year. Other schools may study the decision over a period of months.

At Pebblebrook High School in Cobb County, Georgia, the decision to introduce Applied Mathematics was made in July for the coming fall. "If we had studied the decision for a year, it might not have been as effective," Principal Susan Goldsmith said.

"When administrators and faculty attended the SREB staff development conference in 1991, we already knew we wanted to improve student learning and that we needed to make academic courses more relevant," Ms. Goldsmith said. "The conference gave us the impetus to move forward."

Meeting the following week, the mathematics faculty decided to replace general math and elementary algebra with Applied Mathematics I for 9th grade students. All eight math faculty members received training in Applied Math, and five of them taught a total of 10 sections during the fall semester.

Parents of students who had signed up for general math and elementary algebra received a letter before school opened, notifying them of the new course and describing it as a "better answer" that "provides more options" for students. The change was explained in more detail at an orientation for students and their parents.

During the 1991-92 school year, teachers of applied courses at Pebblebrook had two hours of paid planning time before each unit began. They also met in the summer to review the past year and make plans for the coming year.

Students and teachers at Summerville High School in South Carolina are enthusiastic about applied courses. Summerville offered 10 sections of applied courses in 1991-92, including Applied Mathematics, Principles of Technology, and Applied Communication. School officials planned to increase the total to 40 in 1992-93, including eight new sections of Applied Biology/Chemistry.

Summerville attributes its success with applied courses to:

- Selecting teachers from the college prep curriculum to teach the initial courses;

- Allowing applied academic courses to count for college prep credit;
- Enrolling a cross section of students in the courses;
- Acquainting parents with the courses, and getting approval for their children to enroll;
- Providing teachers with necessary staff development and materials.

Adapting Applied or Situated Learning Strategies into the Regular College Preparatory Curriculum

Schools that seek to upgrade the curriculum and answer the question, "What good will this do me?" are incorporating applied learning strategies into traditional college preparatory math and science courses. This gives many more students in general and vocational programs access to high-level academic content.

Tom Fisher, Applied Mathematics teacher at Woodward High School in Oklahoma, says teachers assigned to regular academic courses hear about applied methods from students in class or from other teachers at staff meetings. Many academic teachers either create practical examples and activities of their own or consult teachers who use applied methods and materials.

New textbooks reflect a mounting trend in applied learning. "Authors and publishers are including more applied methods," Fisher observes.

Beth Webb, Applied Mathematics teacher at Myers Park High School in Charlotte, North Carolina, says, "It's exciting to see other teachers using applied learning strategies. They are discarding out-of-date materials and techniques and are focusing on what students need for employment in our community," she said. Ms. Webb believes that a teacher who wants to make learning real for all students should first step back and ask the question, "Why is it important to teach this?"

Joe Durham of Woodlawn High School in Shreveport, Louisiana, uses cooperative learning and applied methods in his geometry classes. He divides the class into eight groups of four students each to work on assignments. To help keep them on task, he offers a 10-point bonus to the group that scores highest on the project.

As the SREB pilot project was getting underway at Cedartown Comprehensive High School in Georgia, Kathy Hunt and other mathematics teachers began to add job-related examples to the basic mathematics concepts they taught in regular college preparatory classes. During one class period, Ms. Hunt took her geometry students outside to see a house built by students in a vocational class. "We looked at the parallel lines of the framework, doors, and windows and the transversals or diagonal 2 x 4's in the corners," she said. "We talked about the congruent triangles of the rafters that are necessary to hold up the roof."

"The vocational students, who already knew why the house was built the way it was, really lit up when they learned the theories of geometry behind it," she said.

Cooperative Learning

Much educational research in recent years has been devoted to "cooperative learning." Although there are many forms of this instructional method, the most successful versions incorporate group goals and individual accountability as the key elements. The emphasis is on learning rather than doing, and the group's reward depends on whether every member of the group learns the assigned material.

Cooperative learning is used frequently as an applied learning method. It allows students in academic and vocational classes to draw on each other's individual knowledge and experiences to master new information and procedures, and it teaches students the teamwork that is valued in the modern workplace.

Robert E. Slavin, author of *Cooperative Learning: Theory, Research and Practice*, says the method encourages students to discuss, debate, and disagree—to make the classroom "hum" with the active use of knowledge and opinions. Having students act as teachers in their groups strengthens their own learning.

Floyd Byrd, algebra teacher at Woodlawn High School in Shreveport, Louisiana, uses industry as the model for organizing his classroom. Working in groups of four or five, students are responsible for "producing or manufacturing solutions to algebra problems," Byrd said. "If a member of the group is uncooperative and isn't doing his or her share of the work, the others 'fire' him."

Highlights of Research on Cooperative Learning

- To enhance student achievement, the most successful approaches have incorporated two key elements: group goals and individual accountability. Group rewards are based on the individual learning of all group members.
- When group goals and individual accountability are used, achievement effects of cooperative learning are consistently positive.
- Achievement effects of cooperative learning are about the same for all grade levels in all major subjects in urban, rural, and suburban schools. Effects are equally positive for high, average, and low achievers.
- Positive effects of cooperative learning have been found consistently on such diverse outcomes as self-esteem, intergroup relations, acceptance of academically handicapped students, attitudes toward school, and ability to work cooperatively.

Robert E. Slavin

Cooperative learning is new to many teachers and students, who are accustomed to working in isolation in the school setting. Teachers have to learn to manage the cooperative learning process, while students have to learn to share their ideas and their work with others and to be dependent on others for results.

"It's a change for students and can be intimidating at first," admitted one Applied Communication teacher.

Ultimately, cooperative learning creates an environment where quality education and caring about others are important. Students know they belong to a group that supports their efforts.

Benefits of Applied Learning Methods

Applied learning methods have the potential to benefit high school students and teachers in a number of important ways:

Students reach higher levels of achievement—SREB sites with the greatest gains in student achievement use the Elements of Applied Learning. Two sites experienced significant gains in mathematics achievement after introducing Applied Mathematics to the curriculum (see Table 13).

TABLE 13

**Comparison of Mathematics Experience and Achievement
of 1988 and 1990 Vocational Completers At Two SREB Pilot Sites**

	SITE A		SITE B	
	1988	1990	1988	1990
Algebra I	38%	51%	56%	66%
Algebra II	6%	4%	28%	14%
Geometry	26%	23%	16%	20%
Applied Math	0%	23%	0%	35%
Total Math Credits	2.2	2.8	2.2	2.3
Math Scores	281.9	289.4	283.4	293.9

Note: The percentages and the credits were derived from an analysis of student transcript information. The math scores represent the achievement of 1988 and 1990 vocational completers at two sites on National Assessment of Educational Progress math tests. The difference in scores is statistically significant.

An examination of the mathematics courses taken by students at two high achieving SREB sites illustrates the benefits of Applied Mathematics (see Table 14). Students at Site A earned 3.3 math credits; 79 percent of these students enrolled in courses equivalent to Algebra I or higher. Students at Site B averaged 2.6 math credits, and only 38 percent enrolled in upper level math courses. However, 46 percent of Site B students took Applied Mathematics, compared to only 2 percent at Site A. Based on a traditional mindset, students at Site A should have had higher average math scores than students at Site B. Students at Site A earned more math credits, and a much larger percent of students earned two or more high-level math credits through traditional courses. Yet, students at Site B averaged slightly higher scores on the NAEP math test, suggesting that applied learning strategies contribute to achievement of vocational completers. It is not just a matter of enrolling more students in high-level courses; it is also a matter of teaching math in a way that enables students to understand, use, and retain what they learn.

TABLE 14
Comparison of Mathematics Experience
and Average NAEP Math Scores
by 1990 Vocational Completers at Two High-Achieving Pilot Sites

	SITE A	SITE B
General Math	4%	52%
Pre-Algebra	54%	1%
Algebra I	88%	67%
Algebra II	60%	37%
Geometry	82%	46%
Higher Level Math	18%	14%
Applied Math	2%	46%
Total Math Credits	3.3	2.6
Completed 2 Upper Level Math Courses	79%	38%
NAEP Scores	296.8	298.5

Note: The percentages and the credits were derived from an analysis of student transcript information. The math scores represent the achievement of 1990 vocational completers at two sites on National Assessment of Educational Progress math tests. The two sites are comparable in size, school organization, and socioeconomic background of students tested. The difference in scores is statistically significant.

Many teachers who taught some students in the past are finding that these students are more interested and involved when applied learning methods are used. "I've had a lot of these students before, and I can see a difference," says Neta Munsey, Applied Biology/Chemistry teacher at Claiborne County High School in Tennessee. "They are more likely to answer questions and express opinions." Applied learning methods have made students more aware of what is happening with their education. "They realize that they are learning more now than they did in the low-level courses they took in the past," she said.

Students enroll in additional mathematics and science courses—Students who have had success through applied learning often continue with additional courses in mathematics and science. Sometimes the credits are required for graduation, but frequently students have had their interest piqued through applied learning or have developed the confidence necessary to attempt additional high-level mathematics and science.

Students are better prepared for further education—Students who take the challenging applied academic courses find they have a head start on classes at the local community college or area vocational-technical college.

Bill Willard, Principles of Technology teacher at Seneca High School in South Carolina, describes the excitement of a student who discovered that much of the material the class had covered in only three months was on the entrance exam at the technical college. "It made the rest of the class think about what the course meant to them," Willard said.

Tom Fisher of Woodward High School in Oklahoma has had a similar experience with students in applied mathematics. "My students who study at the vocational technical center in the afternoon are eager to tell the other students that what they are learning in Applied Mathematics is what they need in vocational education and on the job," Fisher said.

Students are better prepared for the worksite—The applied learning method emphasizes the thinking and problem-solving skills that employers say they want new workers to have.

Teachers discover a new way to teach—Applied learning methods give teachers new avenues and opportunities to reach greater numbers of students with college preparatory level content. Applied learning is a way for teachers to use their creativity, work more closely with their colleagues, and involve students in activities that contribute to success.

At some SREB pilot sites, academic teachers who previously taught nothing but college preparatory courses agreed to teach two sections of applied courses. When they saw that a "different way of teaching" was successful in helping students master high-level academic content, they took the new techniques and a fresh sense of purpose into their college preparatory classes also.

Carlton Henley, principal at Lyman High School in Seminole County, Florida, encouraged all teachers to adopt applied learn-

ing strategies. First he asked the faculty to list the major learning objectives for students in each grading period. He then distributed the lists, asking each academic teacher to find a vocational teacher with the same or related outcomes. Once the contacts were made, the teachers were given time to plan and coordinate ways to help students use abstract academic knowledge in an authentic situation. Twice a month in faculty meetings, teachers share how they have been cooperating with each other to make academic learning real for non-college preparatory students. A large "help wanted" bulletin board has been erected in the faculty planning area where teachers can "advertise" for assistance with work-related examples or exercises for their academic classes. "Teachers are learning to share and seek ideas," Henley said.

Students find meaning and purpose in school—Applied learning methods allow students to move away from simply memorizing facts. An over-emphasis on recitation leaves many students education-impooverished. Applied learning methods enable students to create meaningful and personally relevant patterns of organizing and retaining information. "Applied learning is helping students realize that math doesn't just happen during a 9 o'clock class at school. It's used all the time to solve real problems," Principal Henley said.

Students acquire a new sense of self-worth—Students' attitudes are involved in learning. Through applied learning, students observe academic and vocational teachers working together to improve achievement. As a consequence, students feel respect and acceptance from the school "family."

Building Partnerships to Make Learning Real

A number of partnerships must be created in successfully developing applied learning strategies to help students see the practical aspects of English, mathematics, and science. Joint ventures may be created between academic and vocational teachers, high school and postsecondary education, and high school and the private sector:

- ✓ When academic and vocational teachers form partnerships to make learning real for students, academic teachers contribute high-level mathematics, science, and communication concepts, while vocational teachers put knowledge in the context of a job or career. The benefit to the student is multiplied.

- ✓ Another essential linkage is between high schools and post-secondary learning opportunities offered in job apprenticeships, community colleges, and technical schools. High school educators and administrators must be up-to-date on the educational background their graduates will need for success in life and continued learning.
- ✓ Partnerships with business and industry are vital. Schools making the most progress with applied learning listen to business and industry and involve them actively in developing programs of study that emphasize knowledge and skills for life and work.

Many teachers simply are unfamiliar with the multitude of situations in which students in general and vocational programs will need mathematics, science, and language skills. One English teacher admitted, "I'm out of touch with the business world. I really don't know what is expected of students in today's workplace."

Because business leaders know what is required, they are in a unique position to provide teachers with authentic, up-to-date learning projects that enable students to use abstract academic and technical knowledge. Companies can offer learning apprenticeships, workshops, and tours to help students and teachers make connections with the day-to-day realities of offices, shops, and other work settings. Representatives of business and industry can serve on curriculum study committees and career advisory groups, make speeches, assist with class projects, and serve as mentors to students who need extra help in applying academic knowledge to worksite projects.

The Boeing Company in Washington State typifies business and industry's potential leadership role in linking academic and vocational education, school and work, and high school and community college. Convinced that applied learning methods contribute to a better-qualified work force, Boeing invested large sums of money and management know-how in helping schools obtain applied academic courses and materials and in training teachers to use applied methods. Following a statewide competition, 10 applied academics teachers participated in 10-week summer internships at various Boeing divisions. Teachers saw first-hand how subjects they teach are put to work in a state-of-the-art environment.

The Boeing project also connected high schools and community colleges in an accelerated program of study. The company

provided seed money for staff from two community college districts and their feeder high schools to design a model Tech Prep program.

Recognizing the importance of alliances between business and education in accelerating the academic achievement of work-oriented young people, a number of companies and industry groups have formed partnerships with SREB site schools.

The Apprentice School of Newport News Shipbuilding and Drydock Company, the largest of its kind in the nation with 28,000 employees, works closely with Norview High School in Norfolk, Virginia to communicate the company's advanced mathematics and science requirements and help counselors stay abreast of changing needs at the worksite.

In Charlotte, North Carolina, representatives of local banks, credit unions, and other business and financial institutions assist Garinger High School, North Mecklenburg High School, and Myers Park High School with instruction for students interested in careers in business and finance.

Here are ways business and industry can assist educators in making learning real for students in general and vocational programs of study:

- Help schools devise a staff organization plan to allow an interdisciplinary group of teachers to have students in common, with time to plan and work together to help students reach higher levels of achievement;
- Help teachers find authentic work-related problems and tasks that require students to use academic and technical knowledge;
- Help local schools obtain equipment, materials, and teacher release time;
- Invite academic and vocational teachers and their students to spend time in the work setting;
- Encourage high schools and community college faculties to link their programs and incorporate applied learning into postsecondary education.

Assessing the Effectiveness of Applied Learning Methods

Even though teachers and students involved in applied academic learning are enthusiastic and the number of applied courses is increasing, state and local educators should take precautions to ensure that applied learning does not become another half-hearted initiative to engage the "other" students in low-status classes with little or no intellectual challenge. The intent is not to replace one group of trivial and lackadaisical courses with another. Rather, the intent is to replace low-level courses with ones containing college prep content and imaginative assignments that require students to exert considerable effort.

State and local school leaders and teachers must ensure that applied learning brings positive changes in what non-college preparatory students are taught. Leaders and teachers must:

- ✓ Be able to prove that applied courses contain essential content from college prep courses. A validation process can prevent applied learning from becoming another way to deliver a low-level curriculum of passive drill and practice. Ask representatives of four-year colleges and universities to examine the content and teacher qualifications of applied courses, including observing students and teachers in applied classrooms. Officials from higher education will make better decisions about applied courses if they know what the courses contain. Working together can help colleges and high schools reach an understanding of what constitutes a college prep-level applied course. It can also help them understand that courses labeled "applied" can be challenging.

Arkansas is using a cooperative process to identify applied courses that are eligible for credit in either a Tech Prep or a traditional college prep curriculum. In spring 1992, the Arkansas Board of Higher Education approved CORD's Applied Mathematics I and II as a substitute for Algebra I. The general and vocational divisions of the State Department of Education studied and compared Applied Math and traditional math courses over a period of months before recommending action to the higher education board. "The same approach is being used to decide how to equate Applied Biology/Chemistry and Applied Communication with traditional courses," said Jean McEntire of the Arkansas Department of Education.

- ✓ Make it clear that applied learning represents a major shift in what non-college preparatory students are taught and what is expected of them. Schools must be prepared to support their teachers with materials, equipment, and staff development. The right teachers must be selected to teach applied courses—teachers who believe that the “other” students can meet higher academic standards. Principals are discovering that teachers who are “true believers” are the key to helping students achieve through applied academics.
- ✓ Be able to measure student achievement. Efforts are underway to develop examinations for students completing standard applied courses. The process would be similar to the one used for assessing students who complete Advanced Placement courses. The Educational Testing Service, the Center for Occupational Research and Development, and the Agency for Instructional Technology are collaborating to develop the new exams. In keeping with the content they are designed to test, the exams will include hands-on simulations.

Test results will be reported in WORKLINK, a computerized data base that provides business and industry with information on the performance and skills of high school seniors seeking jobs. The system was developed by ETS in conjunction with the National Alliance of Business, the National Urban League, and the American Business Conference. By providing a record tailored to employers' needs, WORKLINK shows students that high school experience really counts in finding and keeping a job.

There is nothing magical about applied methods and courses. Administrators and teachers have to believe that the “other” students can learn; otherwise, the courses can easily become simply another set of courses, rather than a way to teach college preparatory content to the “other” students.

Summary

Integrating high-level academic studies with vocational studies through use of applied learning methods is a way for students to move from memorizing information to performing complex tasks. Integrating academic and vocational studies involves:

- Exposing students to more complex subject matter and introducing instructional methods that allow students

to use complicated concepts to solve concrete problems in a broad range of vocational studies;

- A school climate and organization to support academic and vocational teachers working together.

Integrated learning is not a model that gives schools and teachers a packaged curriculum or teaching formulas. Rather, it is a dynamic way to evolve into a new method of teaching and learning. It is a way to change what is taught, how students are taught, what is expected of them, how teachers relate to each other, how students relate to each other, and how students and teachers interact.

Chapter 4

INTEGRATING ACADEMIC CONTENT INTO VOCATIONAL COURSES

In a high school in middle Tennessee, auto mechanics students crowd around an old Chevy V8 engine they want to rebuild. To buy parts, the students must first figure the cubic inches of the engine. One student pulls out a pencil and paper and solves the problem, using the correct algebraic formula.

A few years ago, the instructor might have worked the formula for the class or had someone find the answer with a calculator. Not anymore. Now, all students in the class know how to figure cubic inches and solve other complicated mathematics problems as well.

The Changing Face of High School Vocational Education

Hundreds of vocational instructors at SREB pilot sites have taken the first step on a long journey to create a new type of vocational program—one that places greater emphasis on academic content and higher order cognitive skills. In doing so, they are enriching students' lives and preparing them to work and learn in the future.

Here are some ways vocational teachers at SREB sites are helping students develop an appreciation for symbolic learning:

- ✓ A carpentry teacher assigns students to a mythical "construction company" where they calculate materials needed for a job and the cost of materials and labor. The final step is to fill out a bid sheet.
- ✓ In metals class, the teacher heats a marble and drops it into cold water. The students watch as the inside becomes brittle from the effects of heat and cold, just as metal does. In a

demonstration they will never forget, the students learn a principle of physics while studying a vocational course.

- ✓ Food service students use mathematics in the classroom and food lab to figure cost per person for meals, to figure profit and loss, and to convert units of measurement. When they cut a sheet cake into 96 two-inch squares or a pie into eight equal slices, they are using geometry.

Vocational teachers who stress mathematics, science, and communications in their classes:

- Make the connection between abstract academic content, workplace activity, and continued learning in the future;
- Establish themselves as full partners with academic teachers in improving students' understanding and retention;
- Equip students to apply mathematics and science knowledge to increase their performance in agriculture, construction, manufacturing, health, and other vocational fields;
- Provide a purposeful and collaborative environment that fosters deeper understanding of academic content.

The SREB site in West Virginia that includes Randolph County Vocational Technical Center has made noteworthy progress in preparing graduates for the workplace. "When I became director of the area school, the teachers complained that they were getting students who could not read, measure, or do math," center director Glen Karlen said. "They agreed to make changes in the vocational instruction to help improve students' knowledge. For the past five years, we have concentrated on making related academic studies an integral part of vocational education."

The school sponsors a teacher academy each summer where vocational and academic teachers work on ways to motivate and involve students in higher level learning. Vocational teachers talk about basic skills in weekly staff meetings and share successful approaches. They get involved in students' class schedules and encourage them to take higher level academic courses back at the home high school. "As a result of these efforts," Karlen said, "employers tell us that we are sending them better prepared graduates." Randolph led all other SREB sites in

the number of students reporting that vocational teachers stressed academic skills. In interviews, Randolph students said their vocational teachers were incorporating academic competencies into vocational studies by requiring them to:

- Use mathematics and reading to prepare for competitive events in vocational fields;
- Read books and manuals on installing, repairing, modifying, designing, and making things;
- Read textbooks and vocational technical materials in carpentry, electronics, and automotive classes;
- Use complex mathematics operations to estimate auto repair costs and home building and remodeling costs.

Integrated Learning Strengthens the Link Between Academic Knowledge and Skills and Work-Related Problems and Tasks

The process of integrating academic learning into vocational classes must go beyond the traditional approach to academic instruction. A study by the National Center for Research in Vocational Education demonstrates that it is simply not enough to present academic skills in vocational classes as separate drill and practice. "Students resented the instruction and felt that they were just receiving more of the same academics that had already turned them off," reports B. June Schmidt, project director.

It is important for teachers to weave mathematics, science, and communication skills into vocational activities so that students see the connection between the classroom or laboratory and modern technology. Students need to see how academic content relates to designing, building, operating, and repairing things on the job, or to doing the research, synthesis, writing, and editing required to prepare a business, scientific, or technical report.

But vocational teachers, no matter how dedicated or talented, cannot do it alone. They need materials and staff development from school systems and administrators, lesson plans and instructional techniques from resource specialists, and cooperation from academic teachers.

Stressing Academic Skills Through Vocational Instruction Improves Achievement

Students completing vocational programs at SREB sites in 1990 who reported that their vocational teachers often stressed reading, mathematics, and science skills had significantly higher average NAEP scores in all three subjects than students who reported no such emphasis. Almost half of the SREB vocational completers said vocational teachers often stressed reading skills, more than half indicated that vocational teachers often stressed mathematics skills, and about one-fourth responded that vocational teachers often stressed science skills (see Table 15).

- ✓ The average reading achievement scores for SREB vocational completers who reported that their vocational teachers often stressed reading was 2.7 points higher than the scores of other completers. More than half of SREB site vocational completers enrolled in business/office, health, and marketing occupations programs reported that vocational teachers often stressed the importance of reading skills. Fewer than 45 percent of vocational completers from male-dominated vocational programs reported that vocational teachers often stressed reading.
- ✓ The difference in the average mathematics scores of students whose vocational teachers did and did not stress mathematics skills was 9.1 points, about the same as the difference between the scores of students who do and do not choose to take an additional mathematics course. In male-dominated vocational programs, about two-thirds of the trade/industrial completers indicated that vocational teachers often stressed mathematics skills; in female-dominated programs, the range was from 42 percent in health occupations to 50 percent in business programs.
- ✓ The average science scores of vocational completers who said their vocational teachers stressed the importance of science skills were more than 10 points higher than the scores of completers whose teachers provided no such emphasis. Almost 60 percent of SREB site vocational completers in the health occupations program and 45 percent in the agriculture program reported that vocational teachers often stressed science. Less than one-third of vocational completers in home economics, trade, and technical programs indicated that vocational teachers stressed science skills.

TABLE 15
Extent to Which SREB Vocational Completers Reported That
Their Vocational Teachers Stressed Reading, Mathematics, and Science Skills
and Corresponding Average Scores

National Assessment of Educational Progress Results
for 1990 SREB Pilot Site Vocational Completers

	READING		MATHEMATICS		SCIENCE	
	Percent of Vocational Completers	Score	Percent of Vocational Completers	Score	Percent of Vocational Completers	Score
Often stressed	48%	53.8	57%	293.1	26%	271.9
Never stressed/Could not recall being stressed *	23%	51.1	17%	284.0	42%	261.3

* Represents data collapsed from two of four possible responses. Percentages were combined, and a weighted average was correlated.

Note: Percentages have been rounded and do not add to 100 because one other response was available. The difference in scores is statistically significant.

The most dramatic improvement in the achievement of vocational completers between 1988 and 1990 occurred at an SREB pilot site where the major emphasis was on integrating higher level academic content into vocational instruction. The site consists of an area vocational center and two high schools.

In 1988, vocational completers from the site had one of the lowest achievement levels of the original 28 pilot sites. By 1990, vocational completers from this site achieved the Consortium goal in reading and science and made substantial improvement in mathematics (see Table 16). Students in 1990 perceived a major shift in the emphasis of vocational teachers on reading, mathematics, and science (see Table 17).

The improving pilot site did a number of things to promote higher-level academic instruction:

- 1) The director of the area vocational center involved vocational teachers in determining how to increase their emphasis on academic content through vocational instruction.
- 2) The superintendent implemented a seventh period so students could have a full instructional block at the center.

TABLE 16

**Comparison of Average Student Achievement Scores
at an Improving SREB Pilot Site in 1988 and 1990,
and a Comparison of These Scores with SREB's 1993 Goal**

National Assessment of Educational Progress Results
for 1988 and 1990 Pilot Site Vocational Completers

	READING	MATHEMATICS	SCIENCE
Site Scores in 1988	49.4	283.4	251.0
Site Scores in 1990	56.4	293.9	287.7
SREB's 1993 Goal *	55.5	301.0	280.7

* The 1993 goal for SREB pilot site vocational completers represents closing by one-third the gap between their scores and the scores of 1986 students nationwide who indicated they were enrolled in the college preparatory curriculum.

Note: The difference in scores is statistically significant.

TABLE 17

Extent to Which 1988 and 1990 Vocational Completers at an SREB Pilot Site Making Statistically Significant Improvement Reported That Their Vocational Teachers Stressed the Importance of Reading, Mathematics, and Science Skills,

National Assessment of Educational Progress Results
for 1988 and 1990 SREB Pilot Site Vocational Completers

	PERCENT OF VOCATIONAL COMPLETERS		
	Reading	Mathematics	Science
Often stressed			
1988	34.7%	49.2%	31.5%
1990	58.3%	63.1%	39.8%
Never stressed/Could not recall being stressed			
1988	29.8%	22.1%	39.9%
1990	20.4%	15.5%	32.1%

- 3) The vocational faculty agreed to devote at least 15 percent of instructional time to raising expectations and integrating academic content.
- 4) The vocational center added a language arts teacher and mathematics/science teacher to perform three primary roles:
 - Conduct selected team teaching with vocational teachers in applying academic content to vocational projects;
 - Serve as resources to help vocational teachers understand academic concepts and develop an instructional plan to imbed the concepts into the curriculum;
 - Teach related mathematics, science, and communication courses to vocational students.
- 5) Vocational teachers focused more attention on assigning homework that would require students to use academic skills to master the technical content of vocational studies.

- 6) The site adopted a new agriculture curriculum with added emphasis on underlying science concepts and helped other teachers revise their curricula to emphasize integrated academic instruction.

Fundamental Strategies for Integrating Academic Content into Vocational Courses

SREB pilot sites are using basic strategies to integrate higher academic content into vocational courses. Schools and states can:

- ✓ Devise a new vocational program to teach both academic and technical competencies through an integrated curriculum. The Diversified Technology curriculum developed by Mississippi State University and offered at SREB sites in that state includes algebra, geometry, trigonometry, applied physics, electronics, graphics, and robotics. Students spend time in a lab where teachers guide them in completing a range of projects that foster both academic and technical knowledge and understanding.
- ✓ Imbed academic content into existing vocational courses. Vocational teachers at one SREB site incorporated reading, writing, and mathematics assignments into vocational lab projects. The average reading scores of 1990 vocational completers at the site exceeded the Consortium goal; mathematics scores were more than eight points higher than the Consortium average. Sixty-eight percent of students at this site said their vocational teachers often stressed reading, compared to 48 percent at other sites; 76 percent said their vocational teachers often stressed mathematics, compared to 56 percent at other sites.
- ✓ A state can undertake a major revision of an existing vocational curriculum to add significant related academic content. Tennessee revised its 9th and 10th grade agriculture curriculum with a major emphasis on science.
- ✓ Area vocational centers can develop short-term core courses with a strong, related academic and technical base. Ranging in length from one quarter to a full year, these courses are designed to teach related academic content as technical content that is common to more than one vocational field. Examples of these courses include materials science, basic electronics, technical mathematics, technical writing, and basic drafting.

The United Career Center in Clarksburg, West Virginia, an SREB site making significant improvement in achievement, developed a set of semester-length core courses. Students must complete at least four courses over a two-year period.

- ✓ Team teaching brings together academic and vocational teachers to help students master essential academic concepts. Team efforts involve common planning time, a link between academic concepts and their application in the vocational field, and cross teaching that takes academic teachers into the vocational lab and vocational teachers into the academic classroom.
- ✓ Joint learning projects involve one or more vocational teachers and one or more academic teachers working with students they have in common. Teachers assign a project that involves academic and vocational content and is graded in both classes.
- ✓ *Reading to Learn* is a series of instructional strategies aimed at getting students to read and comprehend technical materials.

Getting Students to Read Technical Materials

Students in general and vocational programs must be able to interpret technical instructions and correspondence on the job and critically analyze conflicting views and information on major issues.

The SREB Consortium believes strongly that all vocational completers should study literature as well as career-related reading assignments. When teachers fail to give career-bound students an opportunity to read and discuss, they deprive them of a "literary barometer" with which to measure the progress of their lives and the lives of others.

Helping vocational students enjoy the "art of reading" and helping them see the "need to read" are perennial challenges. The problem presents itself more often with male students, who score significantly lower than female students on reading achievement tests at SREB sites. One reason may be that high schools are better at engaging female students in learning experiences that improve their reading ability. For example, girls are four times as likely as boys to enroll in business courses, which emphasize reading.

Evidence suggests that teachers tend to "excuse" male students from reading content material—they do not expect boys to read and do not use inventive strategies to make reading more enticing. Yet, students of both sexes grow up in an information society where it is essential to read and use technical materials.

Isn't it time to take a hard look at the relationship between the decline in earnings of males with less than a bachelor's degree and the amount of reading they were required or encouraged to do while in school?

Some vocational teachers maintain it is not their job to teach reading, believing that students should be taught to read in lower grades and high school English classes. In truth, the major problem is not that vocational students are unable to read but that they lack the motivation. Students who read at the 8th grade level can read technical materials written for the 12th and 13th levels if they are adequately motivated.

It is the vocational teacher's job to engage students in reading, comprehending, and using technical materials in their fields of study. While most vocational instructors say they would be willing to involve students in learning to read technical materials, only one-fourth of the vocational teachers responding to a 1990 SREB survey said they felt equipped to emphasize reading.

Many vocational teachers need to re-think their instructional approaches. Vocational teachers take pride in being able to teach work-related skills to students who cannot or will not read. This attitude must change. A student's ability to read and use technical materials in his or her field must become a primary purpose of high school vocational programs.

SREB pilot sites making the greatest gains in reading achievement have used an expert trainer to help academic and vocational teachers develop strategies for teaching reading. Teachers become familiar with reading skills needed for certain courses of study and learn how to help students, particularly males, read and retain technical information.

In 1989, three SREB sites in Virginia participated in a *Reading to Learn* program conducted by Raymond F. Morgan, professor of reading education at Old Dominion University in Norfolk, Virginia. He and Judy S. Richardson of Virginia Commonwealth University are co-authors of the text, *Reading to Learn in the Content Areas*.

Reading to Learn includes note-taking and effective reading methods, including the Directed Reading Thinking Activity and the Guided Reading Procedure. Both methods require active participation by students individually and in groups.

Teachers learn techniques to:

- Help students comprehend what they read;
- Involve students actively in learning;
- Help students develop critical thinking skills;
- Train students to use their background knowledge in understanding new information;
- Help students establish clear purposes for reading and monitor whether those purposes are being achieved;
- Instill in students a more positive attitude toward reading.

At Norview High School in Norfolk, Virginia, the *Reading to Learn* program, reading laboratories, and other strategies contributed to improved reading skills of vocational completers, particularly black students, on state reading tests.

Reading to Learn is an ongoing effort that includes classroom observation, team meetings, and follow-up sessions over a period of 12 to 18 weeks. Vocational, English, and mathematics teachers are encouraged to work as inter-departmental teams to develop activities based on the reading strategies. Teachers have time to try new ideas and get back together to discuss their experiences. A "reading team" of academic and vocational teachers at Norview met regularly after the course. The team's first project was to collect lesson plans written as a course requirement and distribute them in booklet form to all Norview teachers.

In follow-up visits to English, mathematics, science, social studies, and vocational classes at Norview, *Reading to Learn* instructors found:

- Students being asked to read more.
- Students reading a wider variety of materials.
- Students being asked to read for a purpose.

- Teachers assessing and building on students' knowledge of a topic before beginning a new chapter or unit.
- Teachers relating vocabulary words to the understanding of concepts rather than asking students to memorize definitions.
- Students working in small groups.
- Teachers using a variety of activities in a single class period.
- Teachers lecturing less and guiding more. They are becoming facilitators and coaches.
- Teachers using reading strategies to strengthen the existing curriculum and meet course objectives. The strategies are not simply added at the beginning or end of a lesson or unit.
- Frequent reinforcement of what students read.
- Teachers using higher level questioning strategies that place more responsibility on students.
- Reading strategies being used to promote critical thinking; students being asked to organize information and justify decisions.

Vocational teachers at SREB sites use a variety of strategies to improve students' reading ability and help them understand the need to read in all types of careers:

- ✓ One health careers teacher distributes a list of a dozen or more statements about a specific topic, such as body temperature, and asks students to agree or disagree based on what they already know. The students check their answers in the book, noting the page number by each statement.
- ✓ A public safety instructor has students fill out a reporting form on the public safety articles they read weekly in newspapers, magazines, books, and trade journals.
- ✓ In preparing male students to read technical materials, teachers at Randolph County Vocational Technical Center in Elkins, West Virginia, use a number of methods, including a cooperative learning strategy called Jig Saw, a research strategy called Whatchamacallit, an end-of-period process called Inquisitive Question, and reading assignments in *Hot Rod*,

Road and Track, and other high-interest, career-related magazines.

- ✓ Teachers at Comanche High School in Duncan, Oklahoma use the four-step Great Books Foundation method to improve reading skills:

- 1) Students read silently;
- 2) Teacher reads aloud;
- 3) Students ask for clarification of the material;
- 4) Teacher and students discuss the material, using factual, interpretive, and evaluative questions.

After a full period of reading and discussion, students write essays on what they have read.

In some schools, a resource teacher works with vocational instructors on ways to improve students' reading skills. While working at Jonesboro Area Vocational-Technical High School in Arkansas, Margaret Purnell recommended teaching reading from the same manuals students use in vocational classes. Some students progressed as much as three levels in reading after the technique was implemented, she said.

Ms. Purnell made lists of key vocabulary words and questions based on course materials. In auto body repair, for example, she taught students to put the steps in repairing a quarter panel into sequence, pick out the main idea in each paragraph, and study the illustrations. "When a chapter has questions at the end, 40 to 60 percent of the answers are found under the pictures and in charts and diagrams," she said.

"Vocational courses have motivation to read built into them," Ms. Purnell believes. "Students realize that if they can't read, they can't do the work. And they won't be able to get a good job."

The key is for vocational teachers to adopt instructional strategies that will help students read and use technical materials. Rather than taking time away from vocational instruction, teachers are able to cover more information. As students develop the ability to read and learn technical information, they progress at a faster rate.

Improving Oral and Written Communication Through Vocational Instruction

Employers are explicit in their preference for workers who can give and receive directions, interpret how-to manuals, and write memos and reports. Employees must be able to make themselves understood by supervisors, fellow workers, and the public.

Vocational teachers at SREB pilot sites are taking positive steps to help students develop sound communication skills:

- ✓ Jane Hogins, business computer applications instructor at Pontotoc Ridge Area Vocational Center in Mississippi, sees marked improvement in the value students place on written and oral communication after they write a resume and cover letter and take part in a 15-minute interview conducted by community business leaders. In preparation, students develop answers to questions asked most often in job interviews. They practice the questions and answers with other students and the instructor, both privately and in front of the class. Questions include, "How would you describe yourself?" "How would your former employer describe you?" and "What are your weaknesses?" These strategies help students gain confidence for the "real" interviews. After the interview, the employer gives the student a rating sheet containing both positive and constructive feedback.
- ✓ From the time they enter 9th grade until they graduate, all students at Muscle Shoals High School in Alabama are immersed in an intensive writing program. Every student uses a word processor to write a paper once a week for English class. Teachers grade the papers and return them to the students to make corrections.
- ✓ An air conditioning and refrigeration instructor at Red River Area Vocational-Technical School in Duncan, Oklahoma, has students learn to spell the 500 most difficult words used in the air conditioning industry.
- ✓ Banking and finance students work with their English and business teachers to keep a daily journal of class notes, vocabulary, and a written summary of each unit. The journal is graded on spelling and grammar as well as content.
- ✓ Students research a topic related to their vocational field and teach it to the class. They are encouraged to design and use vi-

sual aids in the "lesson." Students are graded on quality of the technical content, and clarity and organization of the presentation.

- ✓ Vocabulary BINGO gives a new twist to the classic game. Instead of spelling BINGO, squares on a game card contain words students should be able to pronounce, spell, and define. As the teacher calls out a definition, students cover the word on their game cards. Vocabulary BINGO can be tailored to fit any subject area in any vocational field. Students have fun while expanding, reinforcing, and testing their knowledge of words they will need in their chosen career.
- ✓ By reading newspaper "Help Wanted" advertisements, beginning machine shop students select the job in their field they would most like to have. Their assignment is to keep a notebook on the academic and technical knowledge and skills they learn during the year that would help them get such a job. They interview the personnel director and other employees at local companies to document the history and growth of the business and to learn more about requirements for the job. The project continues into the second year, when students write a summary of findings from the previous year and prepare a resume with their qualifications for the job.
- ✓ Horticulture Instructor Bruce Akins of Comanche High School in Duncan, Oklahoma has his first- and second-year students prepare written and oral reports based on major research projects they conduct for 8 or 9 weeks twice a year. The topics range from water techniques and frequency of watering to using growth hormones and soil pH. For example, students in one project grow tomatoes in different types of soil and report how size, shape, and color are affected. The written research paper contains methodology, graphs and charts, and findings in standard report form. Students are graded on content, grammar, and neatness. Oral reports are presented to children in grades 3 through 5, whose teachers bring them to view the horticulture projects. "The younger kids are not intimidating, and our students have a chance to get comfortable talking in front of groups," Akins said.
- ✓ With complex medical terminology and hundreds of new words to learn, students in the health occupations field appreciate having extra help in the form of charts, diagrams, pictures, and equipment. Students keep glossary notebooks with new words, definitions, and sentences they have written using

the words. Teachers provide cassette tapes, computer software, flash cards, and crossword puzzles to reinforce the new vocabulary.

- ✓ Health careers students report on a disease such as heart attack or cancer that a family member has experienced. They record the reports on audio or video cassettes as a resource for other students.
- ✓ Precision machine technology students in Red River, Oklahoma, work in small groups to list safety rules for major machines in the shop. After the lists have been checked for spelling and grammar, the "old" students explain the rules and demonstrate safety practices to the first-year students. This type of presentation is interesting and challenging for returning students and offers a different learning method for new students.

Integrating Higher Level Mathematics Concepts into Vocational Instruction

In studies of the American labor market, proficiency in numbers ranks as a major determinant of productivity. The basic knowledge and problem-solving skills a person acquires through algebra, geometry, trigonometry, and calculus are needed and valued in today's complex work arena. Without question, students who understand and can apply the knowledge found in college preparatory mathematics will find many open doors for study in science and engineering and employment in business and technical fields.

The U.S. Department of Education's 1989 National Assessment of Vocational Education said the contribution of vocational education to mathematics learning "is based on the observation that the applied, often 'hands-on' approach to instruction in vocational education stimulates student interest in school."

Vocational education—with programs of study such as auto mechanics, building construction, and business—has always contained a considerable amount of mathematics. Now, vocational instructors are seeing the need to increase the emphasis on mathematics for all vocational students.

Systematic Approach—Several SREB pilot sites have made substantial progress in integrating extra mathematics content into the vocational curriculum and instructional process by following a systematic approach. The best practices from these sites provide useful information for other high schools that want to integrate mathematics into vocational instruction:

- ✓ **Administrative Support**—Sites making the most progress have administrators who make the integration effort a priority. They motivate vocational and mathematics teachers to be concerned about student achievement and support the teachers as they endeavor to make mathematics a larger part of vocational instruction.
- ✓ **Establish a Need**—Successful sites establish a need to give more attention to the mathematics skills of students through vocational education. The needs assessment process often includes surveying employers about mathematics deficiencies of entry-level workers and sending teams of vocational and mathematics teachers on field trips to major industries where they hear about the academic weaknesses of high school graduates. Fact-finding creates greater awareness on the part of both academic and vocational teachers and causes them to want to improve the mathematics competencies of students in vocational programs. As a result of this type of experience at St. Mary's County Technical Center in Maryland, Principal Edward F. Fitzgerald said, "Our teachers recognize that educators have a strong obligation to make sure students have the math they need."
- ✓ **Correct the Deficiencies**—Once the need is established, vocational and academic teachers work together to determine why the deficiencies exist and how to correct the situation. Often, an outside facilitator assists teams of teachers with the process. One site freed a mathematics teacher two periods a day for a year to study why vocational students lacked critical mathematics proficiency. These investigative processes usually result in a list of reasons for poor mathematics performance and a series of corrective actions aimed at having students use math knowledge and skills to solve real-life problems in vocational classrooms.
- ✓ **Identify Math Competencies**—The next logical step is to identify math competencies that can be emphasized in each vocational program. In the beginning, sites concentrated on math skills needed for entry-level jobs. Obviously, that wasn't

enough. High school vocational classes must offer the college preparatory level mathematics content that will help graduates find good jobs, advance in the workplace, and pursue additional formal education. Radford Talley, vocational supervisor at Cedartown Comprehensive High School in Georgia, said, "For several months, 15 vocational teachers and six math teachers collaborated on a project to pinpoint the math competencies needed for each program." The committee matched essential math competencies from the college preparatory curriculum with the 11 vocational programs taught at Cedartown, finding more than 650 vocational tasks that require students to use math before the task can be completed and mastered.

- ✓ *Teachers Work Together*—The next step often involves vocational and academic teachers working together over a long period of time to develop and test ways to improve the mathematics skills of students in general and vocational programs. Often, this happens through staff development meetings that continue over the course of a year. Vocational and academic teachers share ways to emphasize mathematics in their classrooms, and vocational teachers provide their mathematics colleagues with specific job-related examples aimed at making math instruction more relevant. When teachers try the ideas, they share the results. Often, academic teachers serve as coaches to help vocational teachers understand a given mathematics concept, while vocational teachers become resource people for applied academic learning strategies.

Professional Development—As more and more vocational teachers take responsibility for helping students use mathematics to solve complicated work-related problems, many discover a need for professional development. Some vocational teachers need assistance in learning higher mathematics functions or in polishing "rusty" math skills.

To meet the need for staff development, some states conduct math institutes and other math courses designed to assist vocational teachers.

In West Virginia, some 200 vocational teachers find it easier to teach math to vocational students following completion of a semester-length course in basic math skills and modern instructional techniques. The course, which counts toward recertification, was initiated by the vocational bureau of the State

Department of Education and was conducted by West Virginia Tech at 10 sites throughout the state. While learning how to teach math to vocational students, the teachers improved their own competencies and demonstrated substantial gains in basic math scores.

"If you're going to ask teachers to incorporate math skills into vocational education, you must make sure they have the skills themselves," says Nolan D. Browning of West Virginia Tech, who directed the course.

A positive spinoff from the math course is a new requirement in West Virginia for beginning teachers in industrial, technical, health occupations, and home economics programs. They must complete a course known as "Applications of Basic Skills in Vocational Education," which emphasizes math, reading, writing, oral communication, and critical thinking skills as they relate to occupational education.

Summer institutes conducted by the Georgia Department of Education for teams of vocational and math teachers were designed to:

- Familiarize vocational teachers with the content of applied math courses;
- Provide math teachers with insight into the amounts and types of high-level math concepts required in vocational education;
- Encourage cooperation among vocational and math teachers in preparing vocational students to perform complicated math functions and to apply that knowledge in real-life situations.

In site visits to schools that sent teams to the institutes, Kathy Sisk of North Georgia College said she was "very impressed by the cooperation taking place between vocational and math teachers." That type of collaboration was modeled at the institutes, where a math teacher delivered the training and a vocational teacher provided examples of how the math concepts can be used in a vocational setting.

Instructional Sequence—A crucial step in increasing the emphasis on mathematics through vocational instruction is one of imbedding math problems in activities for a major vocational project. Schools that have been most successful have made math a natural and necessary part of vocational instruction. Math is

not something students do apart from their vocational labs. Instead, the idea is for students to complete a major vocational task or project, just as they would in a real work setting. Vocational teachers are looking for ways to maximize rather than minimize the use of math in student lab projects.

As an example of "math in action" at Chopticon High School in Maryland, welding students use a number of math concepts to figure out how to build a railroad "bumper box"—the large steel box that separates railroad cars as they sit in the rail yard or are transferred from engine to engine. The students determine how much steel and other materials to purchase, the time needed to complete the job, the welder's salary, the total cost of the job, and what to bill the railroad so that the welding company makes a profit. In a written essay, the students tell what they learned from the project, which math concepts they used in completing the assignment, and whether they think a math background is necessary for someone who is considering a job in welding.

Mathematics Texts—Students who have trouble performing a given math function receive help from teachers or other students and often refer to mathematics resource texts written for vocational education. In all of the more successful efforts to integrate math and vocational instruction, students have a math text for their vocational field of study. This gives the student an excellent reference and the teacher a basis for homework assignments. St. Mary's County Technical Center in Leonardtown, Maryland, uses a number of texts to help teachers integrate mathematics concepts into instructional programs:

- *Practical Problems in Mathematics for Masons*, John E. Ball, Delmar Publishers.
- *Practical Problems in Mathematics for Sheet Metal Technicians*, Fred W. Schumacher, Delmar Publishers.
- *Math Principles for Food Service Occupations*, 2nd Edition, Robert G. Haines, Delmar Publishers.
- *The Associated Contractors of America Instructional Materials*, Oklahoma State University, Stillwater, Oklahoma.
- *Food Service Work Text*, Prentice Hall Media.

- Applied instructional materials from the Georgia Department of Education's Office of Vocational Education.
- Curriculum materials from the University of Missouri.

Benefits of Integrating Math into Vocational Courses—SREB pilot sites that have made a major effort to emphasize math in vocational courses are reaping benefits:

- ✓ Consortium sites experience increases in student math achievement. Vocational completers at one pilot site scored more than 16 points higher than the national mean for vocational students on the 1990 National Assessment of Educational Progress. Not only did students excel, but 85 percent of them recognized that their vocational teachers were emphasizing math as an essential skill. A drafting student offered this testimony: "We use our math quite a bit. I think I use more math in drafting than I do in geometry."
- ✓ As vocational and academic teachers work together, their attitudes change. Academic teachers are more receptive to teaching math through the applied learning method, and vocational teachers are more attuned than ever to teaching math in vocational classes.

Considering that many students say they remember learning certain math concepts in vocational rather than academic classrooms, it becomes essential for vocational teachers to find more ways to stress math.

Instructor William A. Shore makes math the cornerstone and foundation of problem-solving and decision-making activities in his construction classes at Gwinnett County Vocational Center in Lawrenceville, Georgia. "Typically, when construction workers are not physically assembling or disassembling a project, they are utilizing special math skills," Shore tells his students. Math is essential for the estimating phase of construction—from calculating how much lumber and concrete to buy, to figuring the requirements for electricity and plumbing. By incorporating algebra, geometry, and trigonometry into the curriculum, Shore has helped construction students score significantly higher than other vocational completers on Georgia's basic skills test.

Integrating Science Concepts into the Vocational Curriculum

This nation is not likely to make great strides in production, manufacturing, transportation, and health care until workers see the connection between scientific knowledge and the application of that knowledge to improve productivity.

Science and technology are closely akin. Yet, few American vocational students realize it, because science teachers do not make the connection, and vocational teachers do not stress the connection often enough.

Today's highly technical economy demands a polytechnical education—one in which science and math are the basis for everyday problem-solving. A polytechnical education allows young people to be masters of technology by drawing on scientific principles to find solutions to modern-day dilemmas.

To excel in trade and technical courses, such as auto mechanics, commercial electricity, electronics, industrial technological automation, and small engine repair, students must understand the scientific basis of those fields. Several SREB pilot site area vocational centers have elected to offer Principles of Technology (applied physics), taught by a certified science teacher. All students are required to complete the first seven units—force, work, rate, resistance, energy, power, and force transformers—during their first year at the center. Students may be scheduled according to their vocational major, allowing the teacher to relate information more directly to students' needs and interests. It is not unusual for vocational teachers to accompany their students to Principles of Technology to help the science teacher connect the material being studied to the students' vocational field. Most centers have found it beneficial to provide vocational teachers with concentrated in-service education on Principles of Technology so that they can connect science concepts to major instructional units in their vocational classes.

One area school director said, "Our vocational teachers have been willing to give up instructional time for students to take Principles of Technology, because it provides them with the basis for understanding modern technology. Furthermore, my teachers tell me that these courses help their students increase their problem-solving and analytical skills." Teaching this course at the vocational center is a definite advantage to students who have trouble scheduling a science course at their home high school. The close proximity of science and vocational teachers allows for much more integration to occur.

Another tactic used by vocational teachers to beef up the science content of vocational education is to incorporate selected modules from applied academic courses into the vocational curriculum. Modules from Principles of Technology are used in electronics and auto mechanics, and Applied Biology/Chemistry modules are incorporated into agriculture, home economics, and health occupations courses.

The Oklahoma Department of Vocational-Technical Education sponsored a two-week summer workshop in which electronics instructors compared the objectives of Principles of Technology with the objectives of electronics. The consensus was that Principles of Technology could be substituted for a portion of the first-year electronics course. "We learned that science can be integrated into a closely related vocational curriculum," noted Lin Friedemann, former coordinator of instructional services for the State Vocational-Technical Department. The department provided teachers with follow-up in the form of a mid-winter conference and a study designed by faculty at Oklahoma State University. "We felt so strongly about the success of the integration process that we decided to extend the concept to agriculture courses by introducing Principles of Agritechnology," Friedemann said. Agritechnology is physics with agricultural applications.

A unique Industrial Chemistry program at Trezevant Vocational Technical Center in Memphis, Tennessee, prepares students to assist research scientists, chemists, and chemical engineers in scientific lab experiments in industry and medicine. Over a three-year period, students learn to apply major chemistry concepts, such as wet chemical analyses, while mastering the techniques and instruments used routinely in industry and medical quality control.

Great care has been taken to make sure that the skills the students learn are the ones needed in real labs:

- ✓ In writing the curriculum, Instructor Diane Jernigan drew on years of personal experience working in industrial labs.
- ✓ In the third year of the program, students learn to use large instruments, such as a gas chromatograph, an atomic absorption spectrophotometer, and an infrared spectrophotometer. They visit industrial labs where quality control technicians use the instruments to conduct tests on drugs and other products.

- ✓ The Industrial Chemistry lab is set up like an industrial lab rather than a typical high school lab.
- ✓ An advisory committee composed of representatives of major local businesses and industries gives advice and donates thousands of dollars annually in chemicals and equipment.

Where no formal courses exist, vocational teachers at SREB sites are finding many ways to reinforce science concepts in their vocational instruction. One example is a horticulture teacher who calls on his students to be "soil scientists" as they use the litmus test to determine the acidity of someone's front yard or the effects of light on seedling growth.

State-Level Courses—Important scientific concepts that vocational students will need in the future have been incorporated into state-level curriculum revisions in Tennessee. One course blends biology, chemistry, and physics into agriculture, while the other combines science and home economics.

Science IA (Agriscience), studied in the freshman or sophomore year, helps students see the importance of science in agriculture and heightens their enthusiasm for taking additional science courses as juniors and seniors. Rigorous enough to fulfill requirements in both vocational education and science, the course meets the science requirements for college admission in Tennessee. The instructors, who are certified in both agriculture and general science, use a hands-on applied learning method to teach principles from biology, chemistry, and physics in the context of plants, animals, and agricultural mechanics.

The course consists of 33 units in six major sections: Orientation, Leadership, Supervised Agricultural Experience Programs, Animal Science, Plant Science, and Agricultural Mechanics. Twenty-four of the units deal with the application of science concepts to improve agricultural production. Each unit features vocabulary and definition of terms, pencil and paper exercises, laboratory experiments, and research projects that relate science concepts to agricultural functions. Individualized study units include advanced technologies in animal science, advanced technologies in plant science, agriscience in space, and agriscience and alternative energy technologies.

In studying physics of the internal combustion engine, Agriscience students conduct a controlled experiment using Charles' Law to determine the effect of temperature on the volume

of a gas. Balloons filled with oxygen or helium are placed in a freezer, in a refrigerator, at room temperature, and in a heated box. After they check the temperature in each location and measure the circumference of each balloon for expansion and contraction, the students apply what they have found to the operation of a gasoline, diesel, or alternative fuel engine in an agricultural setting.

Samuel C. Ricketts of Middle Tennessee State University, where the Agriscience curriculum was developed, says freshmen students learn topics such as soil, fertilizer, and animal reproduction previously taught in sophomore and junior years. The result is that upper level courses are changing to avoid duplicating the new course.

Glenn Ross, who teaches Agriscience at McEwen High School, says the course is more difficult than the former Agriculture I, but that students "assume this is how it has been all along."

The other Tennessee curriculum revision is Nutrition Science, a laboratory-based course that draws on students' natural interest in food to spark their interest in science. Home economics and science teachers from SREB pilot sites in Tennessee helped write the curriculum. Taught by a home economics teacher and a science teacher working as a team, the course covers the production, processing, preparation, evaluation, and utilization of food. Students are encouraged to use higher order thinking skills and to become active rather than passive learners as they perform experiments in the school science or chemistry lab as well as the home economics lab.

Since nutrition has links to both biology and chemistry, the scientific method of inquiry has been incorporated throughout the course activities. Chemical calculations include weighing; working with fractions, formulas, and equations; and charting graphs. Here are some of the science concepts these students are learning:

- ✓ **Matter and Energy**—Food is converted to energy during metabolism. Through the bomb calorimetry experiment and other lab exercises, students measure the energy in food. They also analyze nutrient and calorie intake to determine the percentages of fat, carbohydrates, and sodium in the diet and body composition.

- ✓ *Acids, Bases, Salts, pH*—in one experiment, orange, red, green, and white vegetables are cooked in an acid, a base, and water to determine the effects of the cooking liquid. The students then chart the characteristics of vegetables as to color, texture, and aroma.
- ✓ *Oxidation/Reduction*—Students study the effects of various liquids on the browning of fresh fruit.
- ✓ *Enzymes*—Through a digestion lab experiment, students investigate how temperature and enzyme concentration affect the reaction speed of the enzyme rennin found in rennet tablets.
- ✓ *Osmosis*—Colored water and wilted celery are used to demonstrate how the celery becomes crisp as the water passes through the cell membranes by osmosis.

Marie Freeman of Knox County Schools, project director for the Nutrition Science course, says students develop writing and reasoning skills by recording and graphing data, predicting and evaluating lab results, and writing lab reports. They also complete a research paper during the year.

Teacher training is a major component of the program. The Tennessee Department of Education, in cooperation with the University of Tennessee and Knox County Schools, conducted a five-day Nutrition Science Institute to train teachers in the pilot project. Participants received one hour of graduate credit.

The institute was an intensive training experience, with presentations by experts in diet and nutrition, health, and science. Time during the afternoon was spent in the lab, with teachers donning white coats and goggles to conduct scientific experiments.

Arlita Hammer, who teaches Nutrition Science to some of the same students she has had in other home economics courses at Karns High School in Knoxville, says the students are showing more interest in this course. "They ask more questions and are willing to pursue an idea in greater detail," she said. After studying metabolism, her students asked a diabetes specialist from a local hospital to speak to the class and then initiated a research project on artificial sweeteners.

Summary

Putting more academic content into vocational courses is vital in developing high school graduates who can apply abstract academic knowledge in new and challenging situations on the job and in life. Vocational teachers can help students see the importance of English, mathematics, and science by making vocational labs an extension of academic learning.

Academic and vocational integration begins with keeping the vocational curriculum intact while seeking ways for vocational teachers to emphasize reading, writing, and related mathematics and science concepts. The next step is to revise what is taught in vocational courses so that students study related academic concepts in sequence in particular vocational fields. Finally, schools may want to do what some SREB pilot sites have done—design a new vocational program that uses broad vocational fields, such as technology, medical science, and food science, as the setting for teaching high-level academic content and complex problem-solving skills.

Chapter 5

ACADEMIC AND VOCATIONAL TEACHERS WORKING TOGETHER

Students in general and vocational studies need to know that vocational and non-vocational teachers are communicating and cooperating to develop challenging learning opportunities that give students a preview of the real world. Teams of teachers working together can help students understand the relationship between academic and vocational studies and see continuity from one subject to another.

When teachers meet as a group to produce joint learning activities or revise the curriculum, they become role models for students in demonstrating the type of teamwork that contributes to success in business and in life.

Schools that have had experience in organizing teachers for academic and vocational integration cite six important characteristics of a team: Communication, joint planning time, joint staff development, cross visitation, interdisciplinary problem-solving, and unwavering support from school administrators.

Learning to Communicate With Each Other

Before academic and vocational teachers can work together, they must learn to communicate. Communication at several SREB sites improved when academic and vocational teachers developed a list of academic competencies in language arts, mathematics, and science essential for work or further education. The teachers used the list to analyze whether the competencies existed in academic and vocational courses. Through the process, teachers discovered a great deal of common learning between academic and vocational courses. They also discovered that many vocational completers pursue a sequence of courses that does not include all the needed competencies.

One effective way to communicate is for academic and vocational teachers to look at each other's curriculum and visit each other's classrooms to observe instruction. Teachers gain greater respect for their colleagues when they know what others are teaching. Visiting also gives teachers an opportunity to see their students in a different light. Students who may not do well in one subject may excel in another.

SREB pilot sites reveal that attempts to foster communication and understanding between academic and vocational teachers have made both groups of teachers much more aware of a common mission and the need to help students see connections in what they learn. For example:

- ✓ Students at the sites noticed more emphasis on academic competencies in vocational classes. They identified practical examples teachers use to show the relationship between vocational content and a given academic concept.
- ✓ Vocational teachers at several sites developed a matrix of mathematics competencies to help give students an opportunity to use major math concepts.
- ✓ Business and home economics teachers at one site selected new textbooks that place greater emphasis on related academic content.
- ✓ Mathematics teachers at another site scheduled class sessions in a vocational lab so students could see a particular mathematics concept demonstrated.
- ✓ A chemistry teacher and a home economics teacher joined forces in a nutrition science course.
- ✓ An automotive teacher and an English teacher assigned a writing project that counts in both classes.
- ✓ Mathematics, science, and vocational teachers designed a joint learning project for students they teach.

To achieve long-term teacher "buy-in," schools must involve most of their staff from the beginning in improving communication between academic and vocational teachers and in creating a vision of how learning improves when teachers work together.

Joint Planning Time

Teachers should not have to "find" time to sit across the desk from each other or around a table to plan what is best for students' learning. Administrators should make sure teachers have the time they need, whether it be daily, weekly, or monthly. Joint planning time may involve two or more teachers and focus on one or more subject areas. It may happen on site or at another school or location.

Teachers who have had the most success in working together see planning time as a "precious resource." When an academic and vocational teacher want to launch a cooperative project, planning time is critical.

Some schools, such as Woodlawn High School in Shreveport, Louisiana, designate one period a day as common planning time for all teachers. At other schools, such as Myers Park High School in Charlotte, North Carolina, teachers appreciate being able to meet during a common lunch period.

The New Castle County Vocational Technical School District in Delaware created an additional period from 2:20 p.m. to 3 p.m. for common planning time. The change necessitated shaving two minutes from each of eight class periods, dismissing students 40 minutes early, and claiming 10 minutes from homeroom period. The district's instructional advisory committee of academic and vocational teachers developed the plan and secured approval from the school board.

In team teaching, a block of time is important just prior to the class or classes to be taught jointly. Teachers review students' progress and plan methods and activities for the upcoming class period.

Joint Staff Development

Since integrated learning is a new undertaking for most teachers, staff development is essential for success. Vocational and academic teachers need information on raising expectations, teaching applied courses, developing four-year programs of study, team teaching, and cooperative learning, as well as on specific subject areas. Even if the topic isn't new, teachers benefit from hearing it presented in the context of vocational and academic teamwork.

Several SREB sites have used the *Reading to Learn* staff development program to promote working together while improving students' reading ability. As part of the program, academic and vocational teachers are assigned to interdisciplinary teams to put the reading techniques into practice. This helps teachers see the mutual need to engage non-college preparatory students in reading and thinking and to support each other in improving students' reading ability.

Some pilot sites have encouraged cooperation among mathematics and vocational teachers by having them share a common experience, such as a two-week mathematics institute. A mathematics teacher is paired with a vocational teacher as they apply algebra, geometry, and trigonometry concepts to solve problems students will encounter in their career fields. Teachers are discovering that they can help students achieve far more by working together than by working independently.

Joint staff development may occur through workshops, conferences, weekend retreats, college-level courses, and visits to other schools. It should be planned by committees of vocational and academic teachers working together to achieve specific goals and objectives and should be on-going rather than fragmented.

Trained faculty members or specialists from district offices or teacher education institutions can conduct the staff development sessions, and business and industry may lend a hand with internships and company tours.

A steering committee of academic and vocational teachers at Trigg County High School in Cadiz, Kentucky, was organized to define joint staff development activities. The first sessions, conducted by university consultants, concentrated on mathematics and reading strategies for vocational and non-vocational teachers.

Cross Visitation

A cross visitation program introduces teachers to courses outside their specialties. Lafayette Parish Career Center in Louisiana initiated a six-phase cross visitation program for vocational teachers from the center and academic and vocational teachers from Carencro High School. The program began with a summer of in-service activities for teams of teachers, pairing an agriculture teacher with a chemistry teacher, for example.

A certified teacher substituted in the classroom while the regular teacher was away for the day. One academic teacher who visited the career center admitted it was "eye-opening" to see firsthand how heavily vocational education depends on mathematics, science, and English. She began meeting regularly with a career center faculty member "to get examples from real job situations in order to involve students more in their classwork."

As follow-up to cross visitation, teachers from both schools met after school and on Saturdays to share what they observed and to make plans for future collaboration. Joint learning projects and cross teaching activities include such initiatives as having a career center nursing instructor and a biology teacher from the high school exchange places in the classroom for a period of time. The visitation program has expanded to include tours of the career center by faculty from two other high schools in the area.

Academic teachers often attribute changes in what they teach and expect of the "other" students to visits with vocational teachers. An English teacher at one high school said, "Before we spent time at the area vocational center, we assumed that about half our students couldn't learn, so we accommodated them in low-level courses. Our experience at the center showed that what we were teaching these students was inadequate."

Interdisciplinary Problem-Solving

Initial meetings between mathematics and vocational teachers at Wheeling Park High School in Wheeling, West Virginia, revealed that students needed help in applying mathematics formulas and concepts in vocational studies. Students were learning formulas and procedures in mathematics classes but did not know why, when, or how to use them in real-life situations. Based on what they learned by talking with vocational teachers, mathematics teachers began to require students to use mathematics concepts to solve problems drawn from vocational courses. Meanwhile, vocational teachers asked for input from academic teachers to plan projects requiring students to use mathematics formulas and concepts in vocational labs. As math and vocational teachers continued to work together, they coordinated the teaching of concepts in math classes with the time and use of those concepts in vocational classes.

In other steps to improve mathematics instruction for students in general and vocational programs of study, Wheeling

Park teachers revised the student handbook to include the math sequence for each vocational major. "The book says if you're going to take a vocational major, you need pre-algebra the first year and Algebra I the second year, and so forth," the head of the math department explained. "Students can be sure they are getting the math they need, and vocational teachers can devise learning experiences that require students to use math knowledge to solve practical problems."

The Wheeling Park committee has completed its work, but math and vocational department heads continue to meet regularly to plan ways to integrate math and career studies.

Support from the Administration

School building administrators who provide tangible and emotional support for the combined activities of academic and vocational teachers are essential to a successful integration effort. The principal of a small high school in the SREB Consortium placed blackboards in the faculty lounge, asking teachers to write the major topic they would address in classes that week. As a consequence, academic and vocational teachers began to alter their teaching plans to include common objectives in a more timely fashion. Another outcome was greater individual initiative on the part of teachers to reach out and work with other teachers on common objectives.

Whole School Involvement

Sites making the most progress have been able to get the majority of their academic and vocational teachers to work together. One large site has a two-day staff development conference at the end of the school year during which academic and vocational teachers share successful cooperative practices to promote student learning. Broad-based involvement of faculty is necessary if a school is to unlock itself from the present system of low expectations and different, less challenging educational content for the "other" students.

Benefits of Academic and Vocational Teachers Working Together

Two SREB pilot sites illustrate the positive effects of academic and vocational teachers working together. Both sites made large gains in the achievement of 1990 vocational completers as compared to 1988 students. Table 18, comparing faculty responses at the two sites with those of teachers at all SREB sites, reveals the following:

- ✓ A much higher percent of vocational and academic teachers reported spending more time together planning ways to coordinate and integrate academic and vocational instruction.
- ✓ A higher percent of vocational teachers reported devoting much more time to reinforcing academic competencies.
- ✓ A higher percent of academic teachers reported devoting much more time to applied learning strategies in their classes.
- ✓ A higher percent of teachers reported that much more emphasis was placed on meetings of faculty and administrators to set goals and ways to obtain them.
- ✓ More vocational teachers reported that they were expected to stress English, mathematics, and science in their vocational classes.
- ✓ All vocational teachers and more than 80 percent of academic teachers reported that they meet with each other to make plans concerning vocational students.

A number of benefits result when vocational and academic teachers begin to talk and plan:

- ✓ Teacher attitudes improve. Academic and vocational teachers begin to realize that they are teaching many of the same competencies, and this helps them feel more comfortable working with each other.
- ✓ Teachers discover they have a common purpose to help students become lifelong learners and workers. This discovery leads to a greater willingness to cooperate.

TABLE 18

Comparison of Percent of Vocational and Academic Teachers Giving Emphasis to Key Practices at a High-Achieving Site, an Improving Site, and at all 38 SREB Sites for 1990

	HIGH-ACHIEVING SITE		IMPROVING SITE		ALL SITES	
	Voc	Acad	Voc	Acad	Voc	Acad
1. Teachers place much more emphasis on:						
a. Amount of time they work together to combine and integrate academic and vocational instruction	75%	48%	46%	41%	21%	15%
b. Amount of time vocational teachers devote to reinforcing academics	57%	34%	61%	42%	25%	10%
c. Revisions in vocational and non-vocational curriculum	50%	45%	53%	58%	30%	22%
d. Amount of time devoted to applied learning strategies in academic classes	17%	24%	31%	53%	16%	22%
e. Meetings of faculty and administrators to set goals and ways to obtain them	42%	51%	77%	69%	30%	28%
2. Vocational teachers are expected to stress communications, mathematics, and science skills in their vocational field.	83%	—	69%	—	59%	—

TABLE 18 (cont'd)

	HIGH-ACHIEVING SITE		IMPROVING SITE		ALL SITES	
	Voc	Acad	Voc	Acad	Voc	Acad
3. Academic teachers meet with vocational teachers to make plans concerning vocational students.						
a. Do not meet	-	14%	-	16%	-	63%
b. Less than once a month	-	72%	-	73%	-	28%
c. Once a month or more	-	7%	-	11%	-	7%
d. No response	-	7%	-	-	-	2%
4. Vocational teachers meet with academic teachers to make plans concerning vocational students.						
a. Do not meet	-	-	-	-	34%	-
b. Less than once a month	100%	-	92%	-	48%	-
c. Once a month or more	-	-	-	5%	12%	-
d. No response	-	-	8%	-	6%	-

Note: Both sites had to make special efforts to encourage academic and vocational teachers to work together.

- ✓ Teachers gain a better understanding of the total school curriculum and how pieces can be linked together into a more unified whole. This understanding helps diminish the isolation some teachers feel in the high school setting. One teacher said, "We are not separate anymore." Another said, "The faculty came together and focused on one goal. It has made us strong."
- ✓ Teachers start believing every student is important.

- ✓ Teachers realize the current high school curriculum is inadequate to prepare career-bound students for employment and further study. One principal said, "We learned that we were insensitive to the fact that career-bound students were not given the same attention as other students. We had been placing our hope on only a few students. When we emphasized academic and vocational teachers working together, we saw that teachers can be successful in presenting a more determined curriculum to career-bound students. This experience laid the foundation for our high school to eliminate the general track and proceed with an upgraded academic core for all students."

Major Ways Academic and Vocational Teachers Work Together

The teamwork of academic and vocational teachers is an essential condition in getting many students involved in an accelerated program of study. Many alienated high school youth discover a sense of self-worth and form attachments to the total curriculum through the effects of teacher teamwork.

Teams of teachers can create a small-school environment that gives a certain group of students an important feeling of belonging. The result is a richer, more satisfying learning experience that affects the ability of students to identify with school activities.

In *Savage Inequalities: Children in American Schools*, (1991), teacher and author Jonathan Kozol (1991) paints a bleak picture. He found large urban schools to be "extraordinarily unhappy." With guarded doors, police patrolling the halls, and steel grates covering the windows, the schools he visited reminded him of "garrisons or outposts in a foreign nation."

Schools where academic and vocational teachers work together take on a "human" quality, providing students with the types of fellowship and sharing traditionally found in families and religious groups. Teams of teachers send students the message that there are adults at school who care about them and are willing to take the time to plan together and work together to help them achieve their greatest potential. It is this type of caring and concern that stimulates students to invest more time and effort in achieving in high school.

One SREB pilot site—where the reading and math achievement of vocational completers improved dramatically from 1988 to 1990—registered a significant gain in the percent of students who reported that teachers were making special efforts to improve reading, writing, and mathematics skills (see Table 19).

The principal of the school where the survey was conducted attributes the change in students' perceptions to new initiatives bringing academic and vocational teachers closer together. This site made a special effort during 1988-89 and 1989-90 to give vocational and academic teachers opportunities to work together to improve the English and math competencies of non-college preparatory students. Teachers participated in a week-long workshop each summer and continued to meet and plan throughout the year.

Team Teaching

Team teaching makes it possible to merge talents and knowledge of teachers from two previously discrete but obviously related disciplines such as physics and auto mechanics, or geometry and drafting. It is an ideal way to blend the essential content from college preparatory course work with vocational-technical education to help students make connections between success now and in the future.

TABLE 19

Average Percent of Vocational Completers at an Improving SREB Site Who Reported that Teachers Were Working Together to Improve Academic Skills

	VOCATIONAL COMPLETERS	
	1988	1990
Teachers Were Working to Improve Skills in:		
Reading	53%	92%
Writing	39%	81%
Mathematics	59%	78%

At Swain County High School in western North Carolina, biology teacher Janet Clapsaddle and health occupations teacher Joan Thomas admit they "jumped at the chance" to collaborate on the development of a new applied science course for health occupations students.

Even though high-quality health care facilities in the area provided an abundance of employment opportunities, Swain County students tended to shy away from preparing for health careers because of the demanding science courses associated with that major. Clearly, the team's task was to make biology and chemistry more palatable to students wanting to prepare for jobs in hospitals, nursing homes, and health centers or pursue additional education in the health field. The challenge was to design a science course with the rigor of college preparatory science courses but taught in the context of health careers.

Careful planning as a team characterized the project from the beginning. As the two teachers constructed the new applied science course, they consulted regularly and at length on learning activities and strategies.

At the request of both teachers, the administration allocated a block of time in the daily schedule for this team teaching effort. The two instructors are paired with the same students for two hours, first in applied science and then in health occupations. The extended class time lends continuity to the effort and makes it easier to take the students on field trips and to involve them in longer lab experiments. In addition, the paired teachers have a one-hour common planning period immediately preceding the class to prepare for classroom and lab activities and to make course adjustments.

When additional time is needed to review materials, order supplies, schedule field trips and guest speakers, and plan activities, the team can arrange for substitutes to teach their classes for half a day.

Joint planning sessions help the two Swain teachers structure the team-taught course, define roles, and decide who does what in the classroom. Instructional roles change from day to day—one teacher leads the class while the other provides support, depending on individual academic strengths and the day's learning objectives.

The two classes are well-coordinated, leaving no doubt about the relationship of science to health careers. For example, when

it is time to learn about nutrition and the digestive system in health occupations, the teachers have the students conduct lab experiments in science class to determine the effects of various factors on enzyme activity and to compare the heat energy released by burning certain foods.

As a result of the team effort, students at Swain County High School are more aware of the connection between science and health occupations, and many of them enroll in advanced science courses and take a fourth science course during senior year.

Joint Learning Projects

A joint or cooperative learning project that combines language arts, mathematics, and science with a vocational subject is a natural way for students to become actively involved in their education. Cooperative learning allows students to benefit from the coaching and assistance of several teachers in an assignment that may take a few days or weeks or extend over an entire school year. This type of project brings a new dimension to learning by requiring students to be creative, informed, and committed to the task of carrying out a chosen or assigned project. It helps students enhance their technical literacy skills and develop the critical thinking and problem-solving patterns that are so necessary for success in real life.

The Senior Project at Paul M. Hodgson Vocational-Technical High School in New Castle County, Delaware, combines language arts and a vocational major in a year-long endeavor that all 12th graders must complete. The project consists of three P's: *the paper*, a major research paper for an English grade; *the product*, a tangible product for a shop grade; and *the presentation*, a 10-to-30-minute oral report for an English grade.

The project originated in informal conversations by a group of academic and vocational teachers seeking ways to reinforce academic learning in vocational education. The original group gave rise to an "exhibition of mastery" committee composed of an English teacher, a shop teacher, a special needs teacher, and the school librarian. Committee members brainstormed ideas for the project at staff development workshops at school and out-of-state. The next step was to draft a comprehensive manual outlining the proposed project, which was presented to staff and seniors for review. A new and expanded Senior Project Evaluation Committee incorporated suggested revisions and presented the

final plan to seniors and staff to discuss how it was to be implemented.

Despite grumbling from a few students who didn't see how they could "do all this work and graduate, too," seniors selected their topics and began work on their projects. (In subsequent years, topics have been selected near the end of junior year.)

Topics range from replacing an auto windshield to the care and treatment of autistic children. Other topics include old house restoration, baldness and hair transplantation, greenhouse management, and computer crime.

Seniors and their parents sign a contract of understanding that successful completion of the project is necessary to fulfill certain academic and vocational requirements for graduation.

Each student has an advisory committee of three or more faculty members to provide guidance during the project and to assign a grade when the project is completed. Students can also invite business representatives to serve on the committee.

The student's faculty advisory committee members hear the oral presentation, which students consider to be the most difficult aspect of the project. Teachers use a special form from the project manual to rate the student (excellent, good, satisfactory, or unacceptable) on content, organization and plan of work, communication skills, and personal appearance.

The Senior Project Evaluation Committee is careful to point out that the project doesn't replace competency-based training in the career areas, but is designed to reinforce career training by integrating it with the academic curriculum.

A survey of Hodgson shop students at the end of the first year demonstrated that the project had a dramatic effect on the time seniors spent on their education: 56 percent spent more time on homework, 72 percent spent more time on classwork, and 68 percent spent more time working in the shop.

As they improved their work and study habits related to speaking, writing, and self-reliance, students in the project also became aware that vocational and academic subjects are "not as different as some people think."

School-Within-a-School

Students who are intimidated and turned off by a sprawling comprehensive high school find identity and security in the "small school" climate that teaching teams can create.

An "academy" is one way for large schools to create a small school atmosphere to foster enduring relationships among teachers and students. Through the academy concept, a group of 100 to 125 students are block-scheduled in grades 9 through 12 with an interdisciplinary team of teachers in English, mathematics, science, social studies, and vocational courses. Academy teachers use a broad vocational or career field to help students master essential knowledge and competencies from the college preparatory curriculum.

Students in an academy, or school-within-a-school, have a sense of belonging to something special. They develop allegiances to teachers and fellow students and have opportunities to experience success individually and as part of a group.

Myers Park High School in Charlotte, North Carolina, designed an academy program to meet the needs of students at risk of dropping out. As a result of giving special attention to these students, Myers Park achieved the lowest dropout rate and the best daily attendance rate of any school in the system. Now, any student who enrolls in a vocational course included in the academy program is considered to be an academy student.

The school's business academy combines computerized office occupations and accounting with English and math. The academy of home and health sciences links health occupations and commercial foods with English, math, and science.

Vocational instructors teach the academy courses with substantial input from the academic teachers who volunteer to participate. Academic and vocational teachers meet daily during the school year and attend summer workshops to plan unified instruction. In a joint communication project, a vocational teacher helped home and health sciences academy students gather information on jobs in health care and the food industry; an English teacher taught the students how to organize the information and write a job application letter; the vocational teacher conducted simulated interviews based on the applications.

A committee of two English teachers and two business teachers worked to align the curriculum for business and English so

that the competencies required for each field are taught at the same point in the school year. The committee also suggested integrated activities to reinforce the competencies and provided sources of additional exercises.

Guidelines for creating a school-within-a-school include:

- Make sure the academy accelerates academic learning. Special care must be taken to prevent an academy from becoming a new system designed to accommodate or to provide remedial instruction to at-risk and low-achieving students.
- Organize around a career theme that will attract students—health, technology, business, or construction, for example. The curriculum should be challenging enough to prepare graduates for further study and employment.
- Try to enroll a group of students who have the ability to excel but have not been motivated to reach their potential.
- Involve parents and key individuals from the private sector in planning the academy program.

Other Ways Teachers Work Together

A type of collaborative teaching known as a peer partnership has pairs of teachers sharing the same group of students in a two-hour block. A combined English and business block in Orange County, Florida, allows students to use a word processor to complete writing assignments that count in both courses.

Having two teachers in a classroom, one to teach theory and the other to teach applications, works well for some schools.

Clusters have been established successfully in several school districts. In this approach, courses are grouped with similar subjects under such headings as transportation, technology, construction, and consumer education. Academic and vocational teachers are assigned to each cluster.

In a model of organization and planning, teachers at Polytech High School of Kent County in Woodside, Delaware, meet in 45-minute clusters each morning four days a week; on Fridays they

meet by department to share what is happening in the clusters. During the 1991-92 school year, teachers met 140 times—the equivalent of 10 years of meetings at some high schools. Principal Kenneth C. Madden Jr. says the daily sessions allow academic and vocational teachers to coordinate lesson plans and develop joint learning activities in integrating academic and vocational education. Cluster members also identify career-oriented themes, such as interpersonal relationships and quality in work, that are woven throughout all courses.

"Once teachers work together, they see the potential for many innovative projects," Madden said. The school provides substitutes when teachers want to visit other classrooms and is considering full-day and week-long summer planning sessions. Polytech High School teachers use words like "trust" and "empowerment" to describe support they receive from the school. "This is the first time I've been treated like a professional," one teacher said. Another stated, "You are encouraged to try new ideas. If an idea doesn't work, you aren't penalized."

Some schools encourage teachers to act as resources for each other across departmental lines. The approach fosters communication and is less threatening than some methods of bringing teachers together. In some districts for example, mathematics teachers go into science classes when math issues arise. Likewise, vocational teachers regularly visit academic classes to demonstrate real-life applications of academic concepts. Vocational teachers can also make equipment available to academic teachers.

In the case of area vocational centers, on-site reference teams and specialists work with teachers to plan lessons and help teach general skills. This is particularly successful given the isolation of area centers from their feeder schools. In one school, vocational teachers can refer students to an Applied Communication teacher for individual tutoring in communication skills. Randolph County Vocational-Technical Center in Elkins, West Virginia, has a math teacher and an English teacher as an on-site reference team.

It is imperative for every school district that wants to integrate academic and vocational education to examine the barriers that hinder cooperation among academic and vocational teachers and find ways to overcome those barriers. Many effective

strategies have been developed to encourage communication and collaboration among teachers, but the strategies must be adopted and implemented before SREB goals can be achieved.

Joint Academic and Vocational Committees

Two types of committee—one at the system level to provide overall vision and direction and one or more at the school building level to plan and implement specific actions—are necessary for academic and vocational integration.

System-Level Committees—The New Castle County Vocational-Technical School District in Delaware has an instructional advisory council, which meets monthly with the superintendent to address topics such as staff development and additional joint planning time for teachers. The council includes 18 academic and vocational teachers recommended by the principals of the three schools in the district or nominated by their fellow teachers. The three principals and three district administrators also serve on the council. Members volunteer for subcommittees as needed.

School-Based Committees—The size of a school-based committee and its specific plan of action may vary from site to site, but certain characteristics are consistent: participation by academic and vocational teachers, a spirit of cooperation, shared goals for students, prioritized goals and objectives, common planning time, joint staff development, and strong support from the school principal and the district.

The following "model" committee is based on the organization and operation of faculty committees at a number of successful SREB sites. It is offered as a framework for high schools that want to strengthen the teamwork of academic and vocational teachers as they create a better learning experience for students in general and vocational programs of study.

- ✓ **Membership**—From 12 to 25 teachers and administrators may serve on the committee, depending on the size and needs of the school. Some schools want to make sure that all academic and vocational departments are represented; others prefer to let teachers who are most interested volunteer for membership. The principal serves in an advisory capacity and supports the work of the committee. Frequently, the committee includes representatives from business and industry and higher education.

- ✓ **Selection**—Members volunteer or are appointed by the principal. The Palm Beach Gardens, Florida site, where 70 to 120 faculty members signed up for its cross-curriculum committee, believes the volunteer system works best. The 70 teachers were organized into six committees of 10 or 12 members.
- ✓ **Meeting Schedule**—At most schools, the committee starts with weekly meetings. As plans get underway and teachers find more opportunities to work together, the schedule may relax to every two weeks but no less than once a month. A two-hour meeting after school allows time for business and discussion. If more than one school is involved, it is a good idea to rotate the meeting location among the schools. This is an excellent way for academic teachers to learn more about the vocational center and vice versa.
- ✓ **Action Plan**—Each SREB site is asked to develop three-year goals and action plans based on identified needs of students and teachers. Using SREB's Key Practices and Conditions as a framework, the local committee identifies strengths and weaknesses and writes an action plan for each condition and practice. The action plan includes implementation steps, person(s) responsible for each step, timeline, and evidence of success. Subcommittees are helpful in working on components of the action plan.
- ✓ **Subcommittees**—The steering committee for the SREB pilot site at Summerville High School and Dorchester County Career Center in South Carolina has active subcommittees for curriculum, public relations, evaluation, staff development, and remedial instruction. Members include vocational and academic teachers, counselors, administrators, and business and industry leaders. Each subcommittee meets four times a year with a planned agenda. Summerville's organizational structure is designed to improve integrated learning by achieving school and community understanding, acceptance, and communication.

Schools are finding it advantageous to focus on one or two key areas in the beginning. The advisory committee for Norview High School and Norview Technical Vocational Center in Norfolk, Virginia, selected a school-wide *Reading to Learn* project as its first-year priority. Other schools may select an

academic area such as mathematics, a curriculum development project, teacher in-service training, or common planning time.

- ✓ *Agenda*—A committee will want to begin with needs assessment and action planning, moving later to a full agenda of progress reports, subcommittee study reports, and plans for upcoming projects. One advisory committee, which has been meeting for three years, considered the following agenda items at typical meetings:

- Plaudits
- Challenge from SREB
- Identification of Vocational Completers
- Raising Expectations
- Reading to Learn
- Cooperative Relationship Between the High School and the Vocational Center
- Involvement of Business and Industry
- Staff Retreat
- Tech Prep
- Applied Courses/Materials/Methodology
- Mini-Grants
- Technical Reading and Writing
- Time/Opportunities for Collaboration Between Academic and Vocational Teachers
- Joint Planning Time

Summary

Getting academic and vocational teachers to work together is a progressive endeavor that begins by getting them to cooperate on reading, writing, and thinking—educational processes that all students need. The next step involves teams of academic and vocational teachers finding similarities in course content and de-

ciding to stress a common theme, such as human relations, that runs throughout academic and vocational courses. Teamwork often begins with two teachers working together, first on short-term topics and then on a long-term project to involve students in discovering relationships between solid academic skills and the jobs and careers they plan to pursue. The next step is to "team teach" academic and vocational courses—chemistry and nutrition science or biology and health occupations, for example. Finally, as teachers gain confidence in working together, they organize interdisciplinary grade level teams around career clusters so that English, mathematics, science, and vocational teachers can work together to help students master academic content.

Chapter 6

DEVELOPING A CHALLENGING PROGRAM OF STUDY

The integration of academic and vocational education will make little difference if it simply combines low-level academic content with vocational studies. The goal is to teach a new, more advanced level of academic content to students who are not enrolled in a traditional college preparatory program of study. Simply rearranging the pieces to create the appearance of constructive change is a fraud.

The way to avoid another unsuccessful educational reform is to provide an upscale program of academic and vocational study that changes the curriculum content of academic and vocational classes. What is taught and how it is taught are equally important.

Blending College Preparatory and Vocational Studies

A double-purpose program of study that combines vocational and academic content to prepare students for future learning at work and in postsecondary education is the heart of the SREB Consortium effort. It is where "it all comes together" for the "other" high school students.

SREB's recommended program of study for career-bound students is based on a curriculum that blends the essential content of college preparatory math, science, and language arts with vocational studies in grades 9 through 12. The program is also based on teaching non-vocational courses using a functional, applied method that helps students see the usefulness of academic courses.

The program of study SREB recommends for students who do not enroll in a college preparatory program includes:

- The language arts curriculum proposed for college preparatory students.
- At least three (3) credits each in mathematics and science. At least two (2) credits in each subject should be from courses with content comparable to that of college preparatory courses. A student's program of study should include science in the 11th or 12th grade and mathematics in senior year.
- At least four (4) credits in a vocational major with a sequence of related specialty courses.
- At least two (2) credits in related vocational studies, including one-half (1/2) credit in a basic computer course.

The intent of such a program of study is to eliminate the general education track and to provide students with an upgraded and focused program of academic study with a vocational or academic concentration. SREB considers Tech Prep to be a program of study that parallels the college preparatory program.

The goal of SREB's recommended program of study is to create high schools where 90 percent or more students complete the essential elements of English, mathematics, and science currently provided exclusively to college preparatory students—and to do so without lowering the high school completion rate. Based on four years of experience with a network of diverse high schools in 19 states, SREB knows that any high school can achieve this goal in five to seven years if administrators and faculty dedicate themselves to the task.

The SREB Recommended Vocational Curriculum Works

To change the academic achievement of vocational completers, high schools must change what they teach.

- ✓ Twenty-one percent of vocational completers at 28 SREB original pilot sites in 1990 followed the SREB recommended curriculum and had NAEP mathematics, science, and reading scores that significantly exceeded SREB goals and the national average (see Table 20).

TABLE 20

**Students Completing SREB's Recommended Curriculum and
Corresponding Average Reading, Mathematics, and Science Scores**

**National Assessment of Educational Progress Results
for 1990 SREB Pilot Site Vocational Completers**

TYPE OF STUDENT	Percent	Mathematics Score	Science Score	Reading Score
SREB vocational students ¹	100%	290.3 *	268.2 *	53.4 *
Students meeting math recommendation ⁵	38%	303.4 *	285.1 *	57.1 *
Students meeting science recommendation ⁵	33%	302.7	285.7	57.2
Students completing SREB's recommended curriculum ⁵	21%	307.2	292.2	58.5
SREB's goal		300.7	280.7	55.5
National:				
Vocational ²		282.3	266.7	50.4
General ³		288.0	278.6	53.7
All ⁴		300.7	287.1	54.9

¹ Defined by transcript analysis as students completing four or more courses in a vocational major; students at 28 pilot sites only; not a regionally representative sample.

² National representative sample of students who report completing a vocational curriculum.

³ National representative sample of students who report completing a general curriculum.

⁴ National representative sample: all students; all curriculum programs.

⁵ SREB recommended vocational curriculum includes four credits in a vocational area, three credits in mathematics with two equivalent to Algebra I or higher, three credits in science with two being equivalent to college preparatory science courses, and four credits in college preparatory English.

* The difference in scores is statistically significant.

Source: SREB-State Vocational Education Consortium, National Assessment Project, 1990.

- ✓ Thirty-eight percent of 1990 vocational completers met the SREB recommended math curriculum, compared to 29 percent in 1988. With an average math achievement score of 303.4, these students exceeded the SREB goal of 300.7 and outpaced the 290.3 average for all SREB vocational completers.
- ✓ Thirty-three percent of 1990 vocational completers met the SREB recommended science curriculum, compared to 16 percent in 1988. With an average science achievement score of 285.7, this group of students exceeded the SREB goal of 280.7 and scored dramatically higher than the 268.2 average for all SREB vocational completers.

The percentage of students who completed the SREB recommended curriculum varied tremendously from one site to another:

- ✓ At three sites, fewer than 10 percent of vocational completers had a total of three (two upper level) math credits; at three other sites, over 60 percent met the math recommendation.
- ✓ At 12 sites, fewer than 10 percent of vocational completers met the science recommendation; at one site, over 70 percent met the recommendation.

SREB found that the difference lies more in the type of academic courses the students were allowed to take than in socioeconomic factors.

If high schools teach low-level academic courses, students respond with low levels of achievement. This is upheld in a comparison of the academic courses vocational completers took at a low-achieving and a high-achieving SREB pilot site. Both sites are comprehensive high schools of comparable size and student socioeconomic background. Only 16 percent of vocational completers at the low-achieving site met the SREB recommended math curriculum; 7 percent met the science curriculum; and 44 percent met the English curriculum. At the high-achieving site, an overwhelming majority (79 percent) of vocational completers met the SREB recommended math curriculum; 40 percent met the science curriculum; and 94 percent met the English curriculum (see Table 21).

The issue is not whether non-college preparatory students are able to learn, but whether schools believe they can and are willing to change how students are taught. In 1988, only seven percent of

TABLE 21

A Comparison of Vocational Completers Meeting the SREB Recommended Curriculum in Mathematics, Science, and Reading, at a High-Achieving and a Low-Achieving SREB Pilot Site in 1990

RECOMMENDED CURRICULUM	PERCENT OF VOCATIONAL COMPLETERS ¹	
	Low-Achieving Site	High-Achieving Site
Three math credits ²	16%	79%
Three science credits ²	7%	40%
Four English credits ²	44%	94%
Students completing recommended math and science curriculum ²	3%	39%

¹ Defined by transcript analysis as students completing four or more courses in a vocational major.

² The SREB recommended vocational curriculum includes four credits in a vocational area, three credits in mathematics with two equivalent to Algebra I or higher, three credits in science with two equivalent to college preparatory science courses, and four credits in college preparatory English.

Note: Students from the high-achieving high school scored in the upper quartile for all 38 SREB pilot sites on reading, mathematics, and science, while students from the low-achieving high school scored in the lower quartile. The sites were comparable in size, organization, and socioeconomic background of vocational completers.

Source: SREB-State Vocational Education Consortium, National Assessment Project, 1990.

vocational completers at an improving SREB site met the SREB recommended math and science curriculum, compared to 26 percent in 1990. In just two years, this site almost doubled the percent of vocational completers who met the SREB recommended math curriculum, and more than doubled the percent who met the recommended science curriculum. The socioeconomic backgrounds of the 1988 and 1990 students were similar. The experience at this site demonstrates that high schools can quickly change what they teach the "other" students (see Table 22).

TABLE 22

**A Comparison of Vocational Completers Meeting the SREB
Recommended Curriculum at a High School Site Making Statistically
Significant Gains in Average Reading, Mathematics, and Science
Achievement Between 1988 and 1990**

RECOMMENDED CURRICULUM	PERCENT OF VOCATIONAL COMPLETERS ¹	
	1988	1990
Three math credits ²	30%	55%
Three science credits ²	14%	30%
Students completing recommended math and science curriculum ²	7%	26%

¹ Defined by transcript analysis as students completing four or more courses in a vocational major.

² The SREB recommended vocational curriculum includes four credits in a vocational area, three credits in mathematics with two equivalent to Algebra I or higher, three credits in science with two equivalent to college preparatory science courses, and four credits in college preparatory English.

Source: SREB-State Vocational Education Consortium, National Assessment Project, 1990.

Shifting the Focus of High Schools from Accommodating to Educating Students

Educators learned at least one thing from the reform movement of the 1980s: Requiring students to take additional academic classes is practically worthless if the content is weak and students are unable to see a relationship between what they learn now and what they hope to do as adults. Higher requirements are needed. And, teachers must be convinced they can teach college preparatory content to the "other" students.

Most high schools operate on the assumption that students have certain learning patterns that were established in middle or elementary school and that little or nothing can be done in the higher grades to alter achievement. This belief is applied particularly to economically disadvantaged students, who may have undistinguished educational records and do not plan to attend a four-year college or university. Too many high schools compro-

mise the demands of education and society by "accommodating" these students with an assortment of ineffective courses labeled basic, fundamental, or general.

At least 30 percent of 1990 vocational completers from SREB pilot sites never reached the level of Algebra I or its equivalent. Students whose highest mathematics course was General Math had an average math achievement score of 277.2, compared to 286.1 for students who took Applied Math I and 289.3 for students who took Algebra I (see Table 23).

SREB also found that 1990 vocational completers who finished at least Algebra I and geometry averaged 300 on the NAEP math test, the achievement level that SREB recommends for these students. For vocational completers to have the capacity to solve multi-step math problems, they must complete at least two credits of upper level math and be involved in solving real problems in math and vocational classes.

Science courses such as chemistry and Principles of Technology (applied physics) significantly raise the achievement level of vocational completers. Only 29 percent of 1990 vocational completers took chemistry; a meager six percent took Principles of Technology. These students had average scores that

TABLE 23

**Highest Mathematics Course Completed by SREB
Vocational Completers, As Reported by Students,
and Corresponding Average Math Scores**

National Assessment of Educational Progress Results
for 1990 SREB Pilot Site Vocational Completers

HIGHEST MATH COURSE TAKEN	AVERAGE SCORE
General Math	277.2
Applied Math I	286.1
Algebra I	289.3
SREB Goal	300.7

either approached or exceeded the SREB science goal of 280.7. Other vocational completers, meanwhile, were channeled into general science, physical science, life science, earth science, and general biology courses, none of which prepared them to reach average scores of 270 (see Table 24).

Many high schools offer two, if not three, levels of 9th and 10th grade science. The highest level is college preparatory, including a major emphasis on laboratory work. Courses labeled "basic" or "general," on the other hand, usually offer limited lab activities and few opportunities to learn outside of textbooks and lectures. Such courses do little to improve the science achievement of students who take them.

Students know when they are being "warehoused," and they quickly figure out how to get a high school diploma without having to work hard.

TABLE 24

**Science Courses Taken in 1990 by SREB Vocational Completers,
as Reported by Students, and Corresponding Average Scores**

National Assessment of Educational Progress Results
for 1990 SREB Pilot Site Vocational Completers

	AVERAGE SCORE	PERCENT
General Science	264.7	69%
Physical Science	266.5	85%
Life Science	267.2	40%
Earth Science	267.5	60%
General Biology	267.5	90%
Principles of Technology (Year 1)	277.2	6%
Chemistry	283.5	29%
SREB Goal	280.7	

Benefits of Blending an Upgraded Academic Core with Vocational Studies

A program of study with structure and rigorous content helps give direction to students' lives, challenges students to do their best, and shows them how symbolic concepts connect to employment and higher education. Students who complete a demanding sequence of academic and vocational courses are ready to move forward. They escape the frustration and disappointment of discovering that the assortment of courses they took in high school failed to prepare them for life and work.

Even more to the point, students enrolled in general and vocational studies "need high-level academic skills the day after graduation, not four years later," one principal said. "Unlike students who plan to go directly to a four-year college or university, these students do not have the luxury to wait before putting their knowledge to work on the job."

Building a Team to Create a Program of Study

Schools that have made the most progress in developing a challenging program of study for career-bound students have established a broad-based team or committee to study needed changes and make recommendations to the administration and local school board.

If a needs assessment has not been conducted, the committee will want to gather information from students, teachers, parents, employers, local community colleges, and other sources about the knowledge and competencies needed for success in the work setting. At one school, a subcommittee of the existing business and education committee conducted the needs assessment. Among the group's findings were the need for better qualified high school graduates and the need for earlier and more detailed career counseling.

The process of creating a new program of study is neither simple nor quick. "It takes time and patience," says Principal John H. Hostetler of Walhalla High School in South Carolina, an SREB pilot site that eliminated the general track and provided students with a choice between a technical college/career track and a college preparatory track. "Committee members must hear opinions from a lot of people before they make recommendations," he said.

SREB has observed that the best committees include employers and representatives of postsecondary education. Curriculum committees that are limited to academic teachers and central office curriculum specialists have difficulty breaking away from the old way of doing things and tend to perpetuate courses with low expectations. Committees with representatives from business and postsecondary education are more likely to develop a program of study that matches the SREB recommended curriculum.

While some committee recommendations can be enacted by the principal, others must be approved by the school board or district administration. Going to a seven-period day requires district approval; teacher assignments can be decided within the various instructional departments. At the Walhalla High School site, the instructional planning committee selects courses and determines the number of teachers needed for each section; the individual departments distribute the teachers, being careful to discard the old practice of assigning the "veteran" teachers to only high-ability students. As one teacher said, "We should all have an opportunity to teach everybody."

Often, a district-level committee is organized to recommend system-wide changes for high schools and vocational centers. Administrators, curriculum specialists, and representatives of high schools and high school vocational-technical schools in the district sit on the committee, along with representatives of business, industry, and higher education. The committee for York County, Virginia asked each of the three high schools in the district to develop an action plan; these plans were combined to create a district-wide program of study.

Whether school-based or district-wide, the draft version of the new program of study should be circulated widely for input from teachers, administrators, students, parents, the business community, and higher education. In York County, the heads of nine major corporations and top administrators from a nearby college and a university attended a meeting to unveil the new program of study. "This is what students need," they said in supporting the plan.

Major Issues in Developing a New Program of Study

SREB pilot site schools that have sought to improve high school education for the "other" students through a structured, demanding program of study have had to deal with a number of

concerns, ranging from how to win the support of teachers and the community to how to select and sequence courses and structure the school day:

1. How To Convince Teachers, Parents, and the Community That Students in General and Vocational Programs Need a Rigorous, Planned Program of Study.

Many academic teachers who visit a vocational center are amazed by the content of vocational courses, the connection between vocational studies and future careers, and the amount of mathematics and science in the courses. "When they begin to work with vocational teachers on a program of study committee, academic teachers see reasons to give vocational students a heartier helping of English, math, and science in the context of their vocational areas," one principal said. The best way to convince teachers that a change is needed is to show them that the present system is not getting the job done.

Vocational teachers often have to be convinced, too. Many vocational teachers fail to see the need for their students to take higher-level mathematics and science courses. For example, only two percent of vocational completers at SREB pilot sites in 1988 reported that their vocational teachers encouraged them to take more math and science courses. It is not unusual for vocational teachers to advocate exempting students from math and science requirements and to discourage them from taking higher level math and science courses. In doing so, the instructors deprive students of opportunities to prepare for future career advancement.

Pilot sites that have been successful in convincing vocational teachers that their students need to take more math and science have had private sector committees to review the total curriculum experience of vocational completers. Without exception, the committees pointed out that vocational students need a stronger foundation in math and science.

Academic and vocational teachers at one SREB site interviewed managers and employees at 20 businesses and industries. The interviews focused on academic competencies for the workplace and whether students get what they need in high school. The school's math chairman summed up the experience this way: "I learned that the math we teach general and vocational students is totally inadequate," she said.

Parents and the community need to know what the school is doing to strengthen the learning of non-college preparatory students. The SREB pilot site in Phenix City, Alabama produced a videotape to explain its new program of study and designed an all-out marketing plan, including letters, fliers, articles in the news media, face-to-face meetings with employers, and presentations to civic clubs.

2. How To Convince Teachers and Others That Students in General and Vocational Programs Can Master High-Level Academic Content.

Educators need to believe that all students can learn, regardless of family background or previous record of achievement. These students need teachers who expect them to achieve, inspire them to do their best, serve up a tempting array of courses that interest them and have meaning in their lives, and assist them when they need help.

Staff development is critical for any change to take place. Teachers need to know the theory behind a stepped-up program of study and the outcome in other schools. They need exposure to different ways of presenting academic content, using applied learning techniques, cooperative learning strategies, and team teaching. "It's not the content of an upgraded program of study that is different; it's the delivery of that content," says Neils Brooks, Lead Specialist in Vocational Education for the Virginia Department of Education and former director of vocational education for York County Public Schools in Virginia.

SREB pilot sites have done a number of things to convince large numbers of teachers and others that students enrolled in general and vocational programs can achieve in high-level academic courses:

- ✓ Principals and other administrators identified pace-setting faculty members to become involved in the project from the beginning. "I picked teachers the other teachers would listen to," one principal said.
- ✓ Teachers received materials and equipment and participated in staff development activities to enable them to teach high-level academic content.
- ✓ Schools worked hard to showcase new applied academic courses. Teachers gave reports at faculty meetings, focusing on success stories about students whose interest in school was

rekindled due to the applied courses. Teachers who observed the instructional process in applied math, science, and communication labs began to request applied curriculum materials.

- ✓ Sites arranged for vocational and academic teachers to work in teams to help students master complex academic competencies common to both areas of instruction. As they worked together, the teachers came to realize that non-college preparatory students can master complicated learning tasks.

All four factors are important in persuading influential teachers that students *can* learn more difficult material if it is presented in a new way. One science teacher said, "Students who would not have learned anything the way I used to teach biology and chemistry are able to master the content by working in cooperative learning teams to conduct lab activities related to vocational fields of study."

Once a cadre of teachers comes to believe that the "other" students can comprehend high-level academic content, that group of teachers is ready to make major changes in what students are taught and how it is taught.

3. How To Incorporate Courses and Teaching Methods That Will Engage Students in Mastering High-Level Academic Content.

High school academic learning is typically a one-way street, with the teacher lecturing at the front of the room while students sit passively at their desks, expected to absorb instruction with little or no participation in the process. With the advent of applied learning methods and special applied courses, and with the realization that vocational students *need* to see connections between school and work, academic teachers are being encouraged to add variety and meaning to symbolic learning. Staff development is providing them with new techniques that they are using successfully in the classroom. These techniques include having students work in groups to complete tasks and projects, and forming alliances with vocational teachers.

Engaging general and vocational students in mastering high-level academic content requires that academic and vocational teachers change their views on how students learn. They must see that 1) vocational education is a way to bridge the gap between abstract concepts and their practical application in the real world; 2) integrated academic and vocational education expands students' options for learning; and 3) students must be active

rather than passive learners, with teachers providing the stimulus for student involvement.

4. Changing What and How Students Are Taught in Mathematics and Science.

Academic leaders in large school districts seem to have difficulty moving away from the watered-down mathematics and science courses they offer students enrolled in general and vocational studies. Instead of teaching Algebra I so that students can use algebra to solve authentic problems, many schools continue to offer two levels of algebra—one for four-year college-bound students and a different level for the "other" students. Algebra I for students in general and vocational studies is a two-year course in which students manipulate symbols that mean little or nothing to them. The instructional process is basic rote and drill, and the students receive content that has less depth than that of traditional algebra courses.

Many schools eliminate general math but create another math sequence that appears to be almost as ineffective. In attempts to improve math instruction, high schools often do things that have the effect of rearranging the curriculum rather than altering what students are taught and what is expected of them.

A comparison of mathematics sequences for trade and technical students at six SREB pilot sites reveals that most sites have removed general math from the curriculum and are using a variety of approaches to improve the mathematics achievement of vocational students (see Table 25):

- ✓ Sites A, E, and F do not meet the SREB recommended curriculum, which requires students taking a vocational major to complete three math credits, including two at the level of Algebra I or above.
- ✓ Sites B, C, and D require trade and technical students to meet the SREB recommended math curriculum, but the curriculum is highly repetitive. Sites B and D require Algebra I or its equivalent, but it is followed by Applied Math I or Applied Math II, a repeat of Algebra I. These sites offer trade and technical students a series of Algebra I options that appear to be courses that are watered-down and slowed-down rather than taught in a different way.

TABLE 25
Comparison of Mathematics Sequences
Recommended by Six SREB Pilot Sites
for Students in Trade and Technical Studies

	SITE A	SITE B
Grade 9	Algebra I or Applied Math I	Algebra I or I-A
Grade 10	Geometry or Applied Math II	Algebra I, I-A, I-B, Geometry
Grade 11	Elective Math	Algebra I, I-A, I-B, II, Geometry, Applied Math I, Pre-Calculus
Grade 12	None Recommended	Algebra II, I-B, Geometry, Applied Math I, II, Pre-Calculus, Calculus
	SITE C	SITE D
Grade 9	Elementary Algebra	Basic Algebra I, Applied Math I, or Geometry
Grade 10	Elementary Algebra or Geometry	Basic Algebra, Applied Math I, Geometry
Grade 11	Geometry or Intermediate Algebra	Algebra I, II, Advanced Math, Applied Math II, Geometry
Grade 12	None Recommended	Applied Math II, Advanced Math
	SITE E	SITE F
Grade 9	Pre-Algebra	Applied Math I
Grade 10	Applied Math I	Basic Algebra or Algebra I
Grade 11	Applied Math II	Applied Math II
Grade 12	Math Elective	

Source: Analysis of selected programs of study provided to SREB by pilot sites.

Mathematics sequences that would enable vocational completers to meet Consortium criteria would include one of the following options:

TABLE 26

**SREB Recommended Mathematics Sequences
for High School Vocational Completers**

	OPTION I	OPTION II	OPTION III
Grade 9	Pre-Algebra	College Preparatory Algebra I	Applied Math I
Grade 10	College Preparatory Algebra	Geometry	Applied Math II
Grade 11 or 12	Algebra II or Geometry	College Preparatory Algebra II	Algebra II or Geometry

Note: Applied Mathematics I and II is a two-course mathematics sequence designed to cover the concepts of Algebra I and the concepts of geometry, trigonometry, and statistics most needed in the modern workplace.

The SREB recommended mathematics sequences are based on the belief that students in general and vocational programs should study college preparatory level algebra, geometry, and other high-level math content. In doing so, some students respond best to applied learning. Some students may need pre-algebra before Algebra I; others may be ready for Algebra I in 9th grade. The Applied Mathematics I and II courses in the recommended sequence include the material normally taught in Algebra I and much of what is taught in geometry.

Just as they do in mathematics, many high schools offer students in general and vocational programs a series of weak science courses. In contrast, SREB believes that these students should receive college preparatory level science content with a strong emphasis on lab experiments and other activities. Schools should incorporate lab-based learning activities with meaningful connections to students' career interests into existing college preparatory science courses or offer new hands-on courses such as Principles of Technology, Applied Biology/Chemistry, and the American Chemical Society's ChemCom course. General science, basic physical science, earth science, and other science courses

taught below the college preparatory level do little to improve the science achievement of the "other" students.

A comparison of science sequences for students in trade and technical studies at six SREB pilot sites reveals that most sites have yet to do anything to improve 9th and 10th grade science for the "other" students (see Table 27). These students are enrolled in physical science, earth science, and biology courses designed for non-college bound students. Rather than teach college preparatory physical science in a way that the "other" students can grasp, the tendency is to hold onto a curriculum and instructional process that requires students to memorize facts and definitions of terms. Most of these high schools have done little to enroll students in a science sequence linked to their vocational interests. For example, Sites C, D, and F offer earth science rather than lab-based physical science to 9th grade students interested in trade and technical careers.

On a positive note, all six sites offer non-college preparatory students either Principles of Technology or chemistry. Two of the six sites plan to allow students to complete applied biology in lieu of general or basic biology. Only Site E meets the SREB recommended curriculum, which calls for three science credits with content equal to that of college preparatory science courses, yet all six sites recommend three science credits.

The science curriculum for career-oriented students should be linked to their vocational studies. Students interested in designing, making, and fixing technical things should have a science sequence that reflects their interest.

SREB recommended science sequence options for students pursuing vocational clusters are shown in Table 28.

The SREB Consortium recommends that vocational students take science or mathematics in senior year. Principles of Technology is the underlying science for vocational fields with a basis in technology. As with mathematics, a science curriculum that uses the applied method in the early years of high school can capture the interest of students and entice them to take additional science in upper grades.

Red River Area Vocational-Technical School and Comanche High School, an SREB site in Oklahoma, implemented a science curriculum that is lab-based and includes applied instruction in physical science, biology, chemistry, and physics for grades 9 through 12.

TABLE 27

**Comparison of Science Sequences
Recommended by Six SREB Pilot Sites
for Students in Trade and Technical Studies**

	SITE A	SITE B
Grade 9	Physical Science	Basic or Advanced Physical Science
Grade 10	Biology	Basic or Advanced Biology
Grade 11	Chemistry or Principles of Technology	Principles of Technology I, Physics, Chemistry, Advanced Chemistry
Grade 12	None Recommended	Physics, Advanced Biology, Principles of Technology I, II, Chemistry, Advanced Chemistry
	SITE C	SITE D
Grade 9	Earth Science	Biology, Earth Science, Applied Biology
Grade 10	Biology	Physical Science, Applied Biology, Earth Science
Grade 11	Chemistry, Principles of Technology I or Physics	Chemistry, Biology, Principles of Technology I, Physics
Grade 12	Principles of Technology II	Principles of Technology II
	SITE E	SITE F
Grade 9	Physical Science (Regular)	Earth Science
Grade 10	Applied Biology, Applied Chemistry or Principles of Technology I	Biology
Grade 11	Principles of Technology I, II, Applied Biology	None Recommended
Grade 12	None Recommended	Principles of Technology I

Source: Analysis of selected programs of study provided by SREB school sites.

TABLE 28

**SREB Recommended Science Sequences
for High School Vocational Completers**

	OPTION I Trade & Technical Fields	OPTION II Business Studies	OPTION III Life/Human Science
Grade 9	College preparatory physical science	College preparatory physical science or earth science	College preparatory earth science or college preparatory biology
Grade 10	College preparatory biology or applied biology	College preparatory biology or applied biology	College preparatory biology/applied biology
Grade 11	Principles of Technology I	College preparatory chemistry or applied chemistry	College preparatory chemistry/applied chemistry/botany
Grade 12	Principles of Technology II (optional)	Principles of Technology (optional)	College preparatory Biology II (optional)

5. How To Give Students in General and Vocational Studies Access to a College Preparatory English Curriculum.

High schools that believe all students should have excellent written and oral communication skills and be familiar with good literature—regardless of what they plan to do immediately after graduation—have found ways to give all students access to college preparatory English. Here are two examples:

- ✓ Muscle Shoals High School and Vocational Center in Alabama offers all students a common English curriculum with heavy emphasis on reading and writing. Results have been significant: Fewer students are failing English, and students in vocational programs are closing the gap in NAEP reading scores. Male students who completed vocational programs in trade and technical fields at the school surpassed the SREB Consortium reading goal.

- ✓ York High School in Yorktown, Virginia, developed a new type of English with a literature and writing component adapted from the college prep curriculum. Assignments are specific to the student's vocational field of interest.

6. When To Offer Vocational and Academic Courses.

A major issue for schools developing a challenging program of study for career-bound students is deciding when to offer vocational and academic concentrations of courses during the high school experience. *America's Choice: High Skills or Low Wages?* is based on the "classic" way to structure a program of study for career-bound students: to concentrate all English, math, and science in the first two years of high school and hold practical studies for junior and senior year, rather than "stream" academic and vocational courses together throughout grades 9 through 12. Yet, at many SREB pilot sites, the highest failure rates and the highest dropout rates are in grades 9 and 10, when students need reasons to stay in school. If high schools intend to demonstrate to students that what they are learning will help them in the future, the place to do so is in the early dropout-prone, failure-prone years. Schools that "stream" vocational and academic studies in grades 9 through 12 enable students to make real-life connections all four years. Models of this type are successful in reducing course failure rates and in strengthening the achievement of many at-risk students.

Programs of study at the Phenix City, Alabama site provide a sequence of related academic and vocational courses for grades 9-12. The automotive technology program illustrates how to link mathematics and science competencies with vocational studies at each grade level. For example, students are encouraged to take introductory courses in mechanics, metals, and electronics—lab courses that provide many learning opportunities related to mathematics and physical science (see Table 29).

The agriculture cluster at Comanche High School is another example of a sequence of related academic and vocational courses. The cluster provides numerous opportunities to connect higher level mathematics and science concepts to agriculture. This consistency creates an environment in which academic and vocational teachers can work together to accelerate academic achievement (see Table 30).

The Trigg County site in Cadiz, Kentucky offers Introduction to Agricultural Science and Technology in the 9th and 10th

TABLE 29

**Recommended Tech Prep Curriculum for Automotive Technology
at Phenix City High School, Alabama**

GRADE 9	GRADE 10
English	English
Alabama History/World Geography	Health/Driver Ed or semester Elective (Driver Ed not required)
Physical Education	Applied Math II, Algebra I, Algebra II, Geometry, Trigonometry
Applied Math I, Algebra I, Algebra II, Geometry	Automotive Technology I (2 units)
Physical Science (College Preparatory)	Applied Physics I, Computers 1/2, Intro to Electronics 1/2, Entrepreneurship 1/2, or Elective
Introduction to Mechanics 1/2, Introduction to Metals, Computers 1/2, or Introduction to Electronics 1/2	
GRADE 11	GRADE 12
English	English or Applied Communication
American History	Government/Economics
Automotive Technology II (2 units)	Applied Physics II, Physics, Chemistry
Algebra II, Geometry, Trigonometry, or Elective	Algebra II, Geometry, Trigonometry
Applied Physics I or II, Physics, Chemistry	Cooperative Education in Automotive Technology

grades, Introduction to Business in the 9th and 10th grades, and Survey of Technology beginning in the 9th grade to orient students to these fields. The school has had significant increases in academic achievement scores, participation in advanced-level academic courses, and enrollment in higher education. The Greene Central High School site in Snow Hill, North Carolina, which offers an Introduction to Technology course in 9th grade, has reduced its dropout rate.

7. Elimination of the General Track.

SREB and its Consortium partners believe that retaining the general track is a major obstacle in improving the high school experience of the "other" students. Fifteen original sites—including the program's most successful sites—have eliminated the general track or are in the process of phasing it out. Students are required to complete an ungraded academic core and to choose between a vocational or academic concentration and college preparation. These sites have brought the "other" students into more challenging academic courses and helped them achieve new

TABLE 30**Recommended Curriculum for Agriculture Cluster at Comanche High School, Oklahoma****9th Grade**

MATH	LANGUAGE ARTS	SCIENCE	SOCIAL STUDIES	CAREER PREP	ELECTIVES
__Algebra (1)	__English (1)	__Biology (1)	__OK History (1/2)	__Agriculture Ed (1)	__Physical Ed (1)
__Applied Math (1)	__Reading (1)	__Earth Science (1)	__Geography (1/2)		__Intro to Computers (1)
			__U.S. History (1/2)		__Technology Ed (1)

10th Grade

MATH	LANGUAGE ARTS	SCIENCE	SOCIAL STUDIES	CAREER PREP	ELECTIVES
__Algebra II (1)	__English (1)	__Biology (1)	__World History (1/2)	__Agr Prod/Mgt I (1)	__Driver Ed (1)
__Geometry (1)	__Speech (1)	__Chemistry (1)	__Economics (1)	__Nat Resources (1)	__Computer Prog. (1)
__Algebra I (1)		__Prin of Tech (1)	__Geography (1/2)		__Intro to Computers (1)
__Applied Math II (1)					

11th Grade

MATH	LANGUAGE ARTS	SCIENCE	SOCIAL STUDIES	CAREER PREP	ELECTIVES
__Algebra III (1)	__English (1)	__Biology II (1)	__Am History (1)	__Forestry (1)	__Driver Ed (1)
__Geometry (1)	__American Lit (1)	__Chemistry (1)	__Current Events (1)	__Nat Resources (1)	__Computer Prog. (1)
		__Prin of Tech II (1)		__Agr Prod/Mgt II (1)	__Intro to Computers (1)

12th Grade

MATH	LANGUAGE ARTS	SCIENCE	SOCIAL STUDIES	CAREER PREP	ELECTIVES
__Trigonometry (1)	__English (1)	__Botany (1)	__Psychology (1)	__Forestry (1)	__Humanities (1)
__Geometry (1)	__English Lit (1)	__Chemistry (1)	__Current Events (1)	__Agr Mechanics (1)	__Music (1)
	__Applied Comm (1)				

heights through applied academic teaching methods, cooperation among academic and vocational teachers, and extra help for students.

The general track preserves a system that fails to prepare the "other" students adequately for either work or further education. It is based on the deeply held belief that the "other" students cannot master a difficult curriculum and that the only way to protect them from the embarrassment of failure is to give them an academic curriculum that lacks depth and challenge. A prominent educator in one state said, "We must keep the general track. We have a lot of students who could not survive in college preparatory courses."

Too often, the general track is top-heavy with unmotivated students from low-income families. Replacing the general track with a planned program of academic and vocational study allows every student to find a niche in high school and a reason for being there.

When the general track remains in place, a high school is forced to use multi-tracks as a way to solve the poor performance of students. For example, most large high schools have three to six curriculum tracks. There are often three levels for college preparatory students—advanced placement classes, honors classes, and regular college preparatory courses. Below that, there are often one or two additional levels of academic courses in algebra, science, and English which are considered inappropriate for college preparatory students. Finally, there are often mathematics courses, such as general or business math, that are below non-college preparatory algebra.

Some schools developing Tech Prep programs of study are advocating a new curriculum track. In addition to a college prep track, these schools now have Tech Prep, career prep, and general tracks. The SREB Consortium believes there should be no more than two basic paths through high school and that both should be devoted to teaching all students the essential elements of college preparatory math, science, and language arts.

Leaving the general track intact prevents a high school from facing the realities of an inadequate vocational program. When a high school decides on a two-track system of Tech Prep and college prep, it must review its vocational courses. The courses with low expectations and weak connections to employment and postsecondary education must be dropped or revised.

Several SREB schools that have done away with the general track have developed new types of vocational courses, including:

- Broad technology courses created from old industrial labs and curricula.
- "Academies" that combine academic learning with business, manufacturing, or health careers.
- A Diversified Technology curriculum that combines academic and technical studies around modern technology.
- An environmental science program that prepares students to work with hazardous waste materials.
- A revised agriculture or home economics curriculum that includes major emphasis on related science concepts.

8. Organizing the Faculty in a Large High School to Promote Cooperation.

As high schools with 1,000 or more students seek ways to accelerate academic achievement for students who are not in college preparatory programs, they discover that the present system of departmental organization divides the faculty and impedes communication across disciplinary lines. The way large high schools are organized makes it almost impossible for an academic and a vocational teacher to pursue common instructional goals for students they both teach. Agriculture and biology teachers, for example, or geometry and drafting teachers should be able to get together to plan joint learning activities.

Increasingly, large high schools are investigating how to create schools-within-schools composed of academic and vocational teachers and an identified group of students. Each miniature school has 300 to 400 students in grades 9 through 12 and is built around a major theme. The intent is to provide an upgraded academic core that allows students to complete a college preparatory program of study or a major in a vocational concentration.

Large schools often use the "academy" concept to create a small school setting. Teachers work together to devise instructional themes and coordinate the learning of academy students across disciplinary lines. Myers Park High School in Charlotte, North Carolina, and Woodlawn High School in Shreveport, Louisiana, are SREB sites that have academy programs.

In Charlotte, Garinger High School and North Mecklenburg High School participate jointly in an "academy of finance" program. The program is affiliated with the National Academy Foundation, which developed the curriculum. "This is an exciting program that bridges the gap between school and work," says Barbara Tull, program director at Garinger.

The two-year program features information about the world of finance and advanced accounting in the first semester of junior year and banking and credit and advanced accounting in the second semester. As seniors, academy students study financial planning the first semester and international economics the second semester. They take a year-long, college-level finance course that gives them course credit at the high school and a local college or university.

During the summer between the junior and senior year, students serve a 6-to-8 week internship at a local bank or other financial institution. This valuable learning experience is required for completion of the academy. Students participate in pre-interviews at the high school and actual interviews at the companies where they intern.

The North Carolina students work in groups, take field trips to the stock market and the Federal Reserve Bank, and hear guest speakers from the financial community. When a series of articles on "America: What Went Wrong?" appeared in a local daily newspaper, Ms. Tull used the articles for a cooperative learning project in economics. Students worked in groups of three to read an article, write a synopsis, create visuals to illustrate key points, and make an oral presentation to the class. "Everybody did his share, and everybody learned," Ms. Tull says.

Leadership for the program is readily available in Charlotte, an active financial center. The program's advisory committee is composed of 24 executives from banks, credit unions, and insurance companies. Higher education is also represented. The committee gives guidance to the program and arranges for tours, speakers, and internships. The group has been responsible for agreements between the high school and local colleges to enable students to receive college credit for courses in the academy program.

North Mecklenburg has a teacher advisory council composed of one representative from each department in the school. Members notify the program director, Joyce M. Keller, if academy students have problems in any other classes. The academy direc-

tor and a social studies teacher cooperated to have academy students complete a project which resulted in grades in both classes. In the future, the academy director will have a common planning period with English, mathematics, and social studies teachers who also teach academy students.

A parent advisory committee consisting of seven parents of North Mecklenburg academy students meets every six weeks to discuss what the students are learning and suggest ways parents can reinforce the program at home. All parents are invited to one meeting a year, and parents of individual academy students meet with the academy director every nine weeks to discuss their children's progress.

Ms. Keller assigns nightly homework, including having students read financial and career news in magazines and newspapers, like *The Charlotte Observer*, *The Business Journal*, *The Wall Street Journal*, *Fortune*, *U.S. News and World Report*, *Money*, *Black Enterprise*, and *Time*. Students explore the world of finance through articles titled "The Billionairesses," "How Sam Walton Does It," "Lessons from Xerox's Ex-Boss," and "Advice Your Company Can Bank On."

The program gives students a feeling of ownership, Ms. Keller says. "They want the academy to be a good program." She tells about two students who had each been absent from school 18 days the year before they entered the academy. "Now they are interested in school and are attending regularly," she said.

In similar programs nationwide, at least 90 percent of academy students enroll in postsecondary education, including many students who had no previous plans for higher education. Ms. Tull, interviewed when the program was less than a year old, predicted that the percentage of Charlotte finance academy students entering postsecondary education would be over 90 percent.

"One student who was about to drop out of high school 'blossomed' in the academy and has set goals for his life," says Marie Spears, business education specialist for Charlotte-Mecklenburg schools.

9. Cultivating and Maintaining Relationships with Employers and Postsecondary Institutions.

Knowing what is required of students who go to work or enter a community or technical college after high school is the fundamental step in developing a challenging program of study for the

"other" students. Schools that have partnerships with business and industry gain valuable insight into the competencies students must have for the contemporary workplace. Committees of business and industry leaders can conduct needs assessments, review proposed changes in the curriculum, consult with teachers and administrators, host groups of teachers and students, and perform other important roles in assuring that students get what they need in high school.

With the advent of Tech Prep programs of study, the cooperation between high schools and community colleges has taken on a new dimension. Tech Prep programs are designed to provide a necessary background of learning while avoiding repetition from high school to postsecondary education. Tech Prep offers an upgraded academic core that prepares students to enroll in a community college without having to take remedial or developmental courses.

Representatives of business and postsecondary education can help high schools explain to parents why their children should complete a more challenging high school program of study. For example, a technical college helped Fred P. Hamilton Career Center and Walhalla High School in Oconee County, South Carolina publish a new curriculum guide. The technical school provides career center students and their parents with a newsletter on career planning and higher education opportunities.

Model Approaches to Providing a Structured Program of Study for Career-Bound Students

Several states, including Florida, North Carolina, Oklahoma, and West Virginia, have published academic and vocational program of study guidelines that meet or exceed the SREB recommended curriculum. The Florida program, including more than 42 vocational clusters, offers a more rigorous sequence of mathematics and science courses with in-depth study in a vocational cluster.

Students in the Florida program use a Vocational Cluster Information Sheet and a Program of Study Worksheet (see Exhibits 1 and 2). Both examples are for an agri-science cluster which includes agritechnology, environmental horticulture, and natural resources.

EXHIBIT 1**Vocational Cluster Information Sheet**

PROGRAM AREA: Agriculture Education **VOCATIONAL CLUSTER:** Agriscience #1

Vocational Course Sequences for This Cluster:

(Note: Grade level at which course should be taken is shown in parenthesis.)

AGRITECHNOLOGY	ENVIRONMENTAL HORTICULTURE	NATURAL RESOURCES
1 Fund of Agriscience (9)	1 Fund of Agriscience (9)	1 Fund of Agriscience (9)
1 Agriscience Found (10)	1 Agriscience Found (10)	1 Agriscience Found (10)
1 Agritechnology I (11)	1 Intro to Horticulture (11)	1 Forest Ecosystems (11)
1 Agritechnology II (12)	1 Horticulture Science (12)	1 For Nat Resources (12)
1 Applied Ag Skills (12)	1 Applied Ag Skills (12)	1 Applied Ag Skills (12)
- OR -	- OR -	- OR -
1 Ag Coop Ed/OJT (12)	1 Ag Coop Ed/OJT (12)	1 Ag Coop Ed/OJT (12)

STRONGLY RECOMMENDED ACADEMIC COURSES: 4 credits in science and math

Math for Job/Tech Prep: Pre-Algebra, Applied Math I, Applied Math II, and Algebra II or Geometry

Science for Job/Tech Prep: Earth or Physical Science, Biology, Chemistry, and Botany or Ecology

Math for College Prep: Algebra I, Geometry, Algebra II, and Calculus (Honors level if possible)

Science for College Prep: Earth or Physical Science, Biology, Chemistry, and Physics, Botany, Ecology, or Biology II

Foreign Language: Suggested for college prep

SUGGESTED ELECTIVES: Computer courses

RECOMMENDED EXPERIENCES OR ACTIVITIES: Agri-business Coop Education/OJT, FFA, and Supervised Agricultural Experiences (SAE) Program

CAREER INFORMATION:

Possible Direct-Entry Careers after High School: Farm worker, nursery worker, landscape aide, plant propagator, forest worker, tree planter

Possible Careers after Two Years of Postsecondary Training: Supervisor and farm or forest manager, food technician, inspector, farm machine operator, golf course superintendent, landscaper, landscape designer, greenskeeper, forest technician, forest ecologist

Possible Careers after University Education: Agricultural scientist, agricultural engineer, biological scientist entomologist, nematologist, agronomist, ag economist, food and environmental inspector, landscape architect, ag extension agent, veterinarian, ag journalist, agricultural educator

Source: Florida Department of Education

Two basic models have emerged as SREB pilot site schools undertake the development of a program of study that "leads somewhere" for students in general and vocational studies.

An Upgraded Academic Core for All Students

One model for achieving a more challenging program of study is to require an upgraded academic core for all students, coupling it with an effort to use functional and cooperative learning strategies. High schools can make the academic core more rigorous by strengthening, adding, or eliminating courses in mathematics, science, and language arts.

Four schools in the SREB Consortium have taken bold strides to upgrade the academic core for all students: Woodward and Comanche in Oklahoma; Muscle Shoals, Alabama; and Trigg County, Kentucky. Three of the schools are among SREB sites making the greatest gains in achievement, while the fourth was already performing at a high level but continued to move ahead while implementing a revised program of study.

The two Oklahoma sites—Woodward and Comanche high schools—recorded a significant improvement in the ACT scores of career-bound students from 1987-88 to 1990-91 after initiating extensive changes in the curriculum. The schools raised graduation requirements and introduced a number of applied academic courses. Both schools require three years of math, two of them equivalent to Algebra I or higher; three years of science, two of them equivalent to college prep lab sciences; and four years of English.

EXHIBIT 2**Program of Study Worksheet**

Student Name:

Program Area: *Agriculture Education*

Student I.D. #:

Program Cluster: *Agriscience #1*

COURSE TITLE

GRADE 9	GRADE 10	GRADE 11	GRADE 12
1 English I	1 English II	1 English III	1 English IV
1 Pre-Algebra	1 Applied Math I	1 Applied Math II	1 Geometry
1 Earth or Physical Science	1 Biology	1 Chemistry	1 Physics or Botany
.5 Life Management Skills .5 P.E.	1 World History	1 American History	.5 Economics .5 American Government
1 Fund of Agriscience	1 Agriscience Found	1 Agriscience Elective	1 Agriscience Elective
.5 Practical Computer Skills	1 Elective	1 Elective	1 Elective
1 Technology Studies I	1 Foreign Language I	1 Foreign Language II	
.5 Performing Arts			1 Applied Ag. Skills OR 1 Coop Ed/OJT

Source: Florida Department of Education.

At two of the four SREB sites that upgraded the academic core for all students, the local school board adopted the changes. The other two sites are succeeding by removing low-level academic courses and encouraging and supporting students as they master a more rigorous program of study.

The unique aspect of an upgraded academic core for all students is that the core is mandatory, but students do not have to concentrate or "major" in any particular field of study. Students may select a vocational or college prep major, or simply take a collection of additional courses.

Upgraded Academic Core with a Major in College Prep, Tech Prep, or an Academic Area

Many SREB sites are eliminating the general track, upgrading the academic core, and requiring students to major in college prep, Tech Prep, or an academic concentration. The factor that sets these schools apart is that students are required to major in something.

Sites that upgrade the academic core and require a major may organize the program of study for career-bound students around broad-based career themes or specific occupations.

Broad-based career themes—The most common way to organize involves broad themes such as technology, business, and human services and some academic major, such as math and science, humanities, and fine arts. This method provides greater flexibility and helps point out similarities in the broad areas. Most sites that organize this way offer several majors in each broad field.

SREB sites that have organized around broad themes are St. Mary's County Technical Center in Maryland; York High School and Norview High School, both in Virginia; Fairdale High School in Jefferson County, Kentucky; Greene Central High School in North Carolina; Polytech High School of Kent County, Delaware; and Walhalla High School in South Carolina.

St. Mary's County Public Schools eliminated the general track in September 1991 and required all entering 9th grade students to complete an upgraded academic core and a major in one of four clusters: applied business and management

TABLE 31
Recommended Curriculum for a Specialization in Electronics
for High School Students in St. Mary's County, Maryland

GRADE 9	CREDITS	GRADE 10	CREDITS
English (Standard/College Prep)	1	English (Standard/College Prep)	1
Civics (Standard/College Prep)	1	World History (Standard/College Prep)	1
Elements of Algebra or Algebra I	1	Elements of Geometry or Algebra I or	1
Earth/Space Science (Standard/	1	Geometry	
College Prep)		Biology (Standard/College Prep)	1
Intro. to Industry and Technology	1	Fine Arts	1
Physical Education	1	(Communications Technology Survey)	1
Elective	1	(Applied Technology Exploration)	1
GRADE 11	CREDITS	GRADE 12	CREDITS
English (Standard/College Prep)	1	English (Standard/College Prep)	1
U. S. History (Standard/College	1	Contemporary Issues	1
Prep)	1	(Standard/College Prep)	
Algebra I or Geometry or Applied		(Algebra 2) or (Trigonometry/Analysis)	1
Mathematics 2 or Algebra 2	1	(Chemistry 1) or (Chemistry in the	1
Principles of Technology I	2	Community) or (Principles of	
Electronics I (2 Hours)	1	Technology 2) or (Physics)	
Elective		Electronics 2 (3 hours)	3

Note: Required Units of Credit for Graduation: English-4, Social Studies-4, Mathematics-3, Science-2, Physical Education-1, Fine Arts-1, Practical Arts-1, Electives-4. Other Suggested Courses: Introduction to Computers, Drafting, Foreign Language.

technologies; applied engineering and mechanical technologies; applied health and human services technologies; or four-year college preparation. St. Mary's developed a four-year curriculum sequence for each of 29 specialties. Students complete two years of math and science at the college preparatory level in all specialties except fine arts, culinary arts, accounting, graphic arts and printing, marketing, secretarial, and agriculture. Table 31 shows the recommended curriculum for a specialization in electronics, while Table 32 illustrates a recommended curriculum for a specialization in science and mathematics.

TABLE 32

**Recommended Curriculum for a Program Specialization in Science
and Mathematics for High School Students in
St. Mary's County, Maryland**

GRADE 9	CREDITS	GRADE 10	CREDITS
English (College Prep)	1	English (College Prep)	1
Civics (College Prep)	1	World History (College Prep)	1
Algebra 1 or Algebra 2	1	Algebra 2 and/or Geometry	1
Biology (College Prep)	1	Chemistry I	1
Foreign Language 1 or 2	1	Foreign Language 2 or 3	1
Physical Education	1	(Introduction to Computers)	1
Fine Arts or Elective	1	(Keyboarding Applications 1) or Fine Arts	1
GRADE 11	CREDITS	GRADE 12	CREDITS
English (College Prep or A.P.)	1	English (College Prep or A.P.)	1
U. S. History (College Prep) or A.P. American History	1	Contemporary Issues (College Prep) or Global Diplomacy or A.P. Government and Politics	1
Algebra 2 and/or Geometry or Trigonometry/Analysis	1	Trigonometry/Analysis or	1
Chemistry 2 and/or Physics and /or Advanced Biology	1	Calculus or A.P. Calculus AB	1
Foreign Language 3 or 4	1	Physics and/or Advanced Biology	1
Computer Science 1 and Elective	2	Foreign Language 4, Computer Science 2, and Elective	3
OR		OR	
Technology Program		Technology Program	

Note: Required Units of Credit for Graduation: English-4, Social Studies-4, Mathematics-3, Science-2, Physical Education-1, Fine Arts-1, Practical Arts-1, Electives-4. Other Suggested Courses: Earth/Space Science, Statistics and Probability, Principles of Technology, Concurrent Enrollment for Advanced Biology Students

York High School organized a Tech Prep program of study around three career clusters: business and marketing; human services; and technology, trade, and industrial. The school urges students to complete SREB's recommended academic core. Students have a choice of a number of concentrations in each career cluster: 6 in business and marketing, 10 in human services,

and over 15 in technology, trade, and industrial. Students receive a brochure that helps them plan a high school program of study leading to employment and further education.

The Fairdale High School site eliminated the general track and revamped its academic and vocational programs so that every student completes an upgraded academic core and concentrates on some aspect of public safety technology: legal and medical office technology, law enforcement and criminology, radio and electronic communication technology, fire science and hazardous materials, or emergency medicine.

Under the leadership of Principal Marilyn Hohmann and a school-based curriculum committee, Fairdale forged a new high school model using concepts and practices from the Coalition of Essential Schools, Deming's Total Quality Management, SREB's *High Schools That Work* program, the Center for Leadership in School Reform, and the school's own successful project. The model is based on the following principles:

- That all students can and must do significant academic work.
- That high expectations is the goal for each student.
- That the student is the worker and the customer, not the product.
- That teachers are the coaches, and that the work they give students is the product. That the product must be quality work, worthy of a student's efforts.

The Fairdale committee envisions a high school that requires all students to complete either a Tech Prep or a college prep program of study. The curriculum is flexible enough that students can do both and can move between the two. The curriculum requires all students to meet and exceed the SREB recommended English, mathematics, and science curriculum. Fairdale has sequenced the curriculum so that academic and vocational studies are related in grades 9 through 12. The committee recommends a school organizational pattern that encourages teachers to work together in teams to help students do quality work. The two programs of study in Tables 33A and 33B represent a high school curriculum built on the belief that a school can get all students to master an upgraded academic and technical curriculum.

TABLE 33A**Framework for a Public Safety Technology Program Using a Tech Prep Model****Fairdale High School - Fairdale, Kentucky**

	GRADE 9	GRADE 10	GRADE 11	GRADE 12
ENGLISH	English I	Applied Communications	U. S. is US	Humanities/English IV
MATH	Tech Math 1	Tech Math 2	Tech Math 3	Algebra II
SCIENCE	Biology	Principles of Technology Applied Biology	Applied Biology Principles of Technology	Tech Chemistry
SOCIAL STUDIES	Street Law	Social/Psychology	(See English)	
TECH COURSES	Public Safety 1	Public Safety 2	Technical Course	Technical Course
PHYSICAL FITNESS	P. E./Health	P.E./Health	P.E./Health	P.E./Health

Students may switch between Tech Prep and College Prep.

TABLE 33B**College Prep Curriculum Suggested Program of Study****Fairdale High School - Fairdale, Kentucky**

	GRADE 9	GRADE 10	GRADE 11	GRADE 12
ENGLISH	English I	English II	U. S. is US (English/US History 2 hour block)	English/Humanities
MATH	Algebra I (Pre-Algebra)	Geometry (Pre-Geometry)	Algebra II (Basic Skills & Intro. to Computers)	Pre-Calculus Calculus
SCIENCE	Physical Science	Biology	Chemistry	Physics (Principles of Technology)
SOCIAL STUDIES	Geography	World Civilizations	U. S. is US (US History/English 2 hour block)	Sociology Psychology
PHYSICAL FITNESS	P.E./Health			

Students may switch between Tech Prep and College Prep.

Specific Occupations—Other schools have organized their programs of study around specific occupational fields, such as auto mechanics, electronics, construction, secretarial, and accounting. Identifying with traditional occupational fields gives students a sense of belonging to something permanent and lets them know what to expect in the fields they choose. SREB sites that base their programs of study on specific occupations include Phenix City High School in Alabama; Swansea High School in South Carolina; Humphreys County Vocational Center in Waverly, Tennessee; and Rockbridge High School in Lexington, Virginia. The curriculum for automotive technology students at Phenix City High School was shown in Table 29.

Students majoring in building construction at Swansea High School complete a program of study that fulfills the requirements of the SREB recommended curriculum (see Table 34).

TABLE 34
Recommended Curriculum for Building Construction
at Swansea High School, South Carolina

GRADE 9	CREDITS	GRADE 10	CREDITS
English I (College Prep)	1	English II (College Prep)	1
World Geography	1	Applied Biology/Chemistry	1
Physical Science (College Prep)	1	Algebra I or Applied Math I or II	1
Pre-Algebra or Applied Math I	1	Social Studies Elective: Law Related	1
Health	1/2	Education, World History,	
Keyboarding Applications	1/2	Psychology, Sociology or	
Elective: Art, Chorus, PE, Band, or		Current Events	
Industrial Technology	1	Introduction to Construction	1
		Elective	1
GRADE 11	CREDITS	GRADE 12	CREDITS
English III (Communications for the Workplace)	1	English IV (Communications for the Workplace)	1
Principles of Technology I	1	Government	1/2
Geometry or Applied Math II	1	Economics	1/2
U.S. History	1	Building Construction	2
Building Construction	2	Algebra II or Geometry	1
		Principles of Technology II or Elective	1

TABLE 35

**Recommended Curriculum for Health Occupations Cluster
at Humphreys County High School, Tennessee**

COURSE TITLE	CREDITS
Grade 9	
English I (College Prep)	1
Pre-Algebra, Algebra I or Math for Technology	1
Physical Science (College Prep)	1
Keyboarding (1 semester)/Software Tools (1 semester)	1
Physical Education	1
Introduction to Health Occupations (or elective)	1
Elective	<u>1</u>
TOTAL	7
Grade 10	
English II (College Prep)	1
Algebra I, Algebra II or Math for Technology II	1
Biology I or Applied Biology/Chemistry I	1
U.S. Government, Geography, or World History	1
Introduction to Health Occupations or special courses such as:	1
Introduction to Sports/Physical Fitness (1 semester - 1/2 credit) or	
Introduction to Physical Therapy (1 semester - 1/2 credit)	
Elective	1
Elective	<u>1</u>
TOTAL	5-7
Grade 11	
English III (College Prep)	1
Chemistry I or Applied Biology/Chemistry II	1
U. S. History	1
Economics (1 semester)	1/2
[Pre-Nursing (1 semester - 2 hours) and	[2]
Nursing/Geriatric Nursing Assistant (1 semester - 2 hours)*]	
OR	OR
[Anatomy and Physiology (1 semester - 2 hours) and	[2]
Clinical Internship (1 semester - 2 hours) **]	
Elective	<u>1 1/2</u>
TOTAL	5-7

Grade 12

English IV (College Prep) or Applied Communication	1
Algebra II (or "Higher Math")	1
Advanced Biology or Chemistry	1
Medical Lab Science	1
Clinical Internship (1 semester - 2 hours) **	1
OR	OR
Health Occupations Co-op **	1-2
TOTAL	5-7

Suggested Options for Electives: Foreign Language, Computers I and II.

* Registered for job readiness by the State of Tennessee, Health and Environment Department.

** Must have satisfactorily completed Introduction to Physical Therapy, Sports/Physical Fitness, or Nursing/Geriatric Nursing Assistant with a minimum of a C average.

The health occupations curriculum at Humphreys County Vocational Center meets SREB recommendations. The curriculum blends an emphasis on a health occupation cluster with a challenging and related sequence of mathematics and science courses (see Table 35).

Summary

High school teachers and leaders who can overcome preconceived ideas about the limitations of the "other" students are successfully creating a curriculum that corresponds with SREB recommendations. Something extraordinary is happening at these high schools. Teachers and students feel better about themselves and their accomplishments. Some high schools are getting positive feedback from employers of recent graduates. For example, a vocational teacher at one high school reported, "Employers are telling us that graduates are better prepared and more disciplined in their efforts to solve difficult problems." Vocational teachers at another site said they see a big improvement in students who come to the area vocational center from a certain high school. "Four years ago, our worst students came from that school," one teacher said.

One key to implementing a curriculum that meets SREB recommendations is to establish a need for it. Another key is to provide support in the form of time, materials, and staff develop-

ment to help teachers see students in general and vocational studies in a new light and to initiate teaching methods to help these students succeed. Support often means unshackling teachers from a tracking system that has conditioned faculty and students to expect too little. Teachers who are given freedom and support will create a curriculum that elicits greater effort and achievement from students pursuing vocational studies.

Chapter 7

GUIDING STUDENTS TO BETTER CHOICES

Students generally are ill-equipped to choose the courses they will take in high school. A typical eighth-grade student lacks the knowledge and information-gathering skills to determine the best educational route to follow.

Teenagers are far-removed from international business competition and rapid advances in technology that have forced large and small companies to seek better educated and better skilled workers. The courses a student's parents and older brothers and sisters studied to do a job probably are not suited to today's economy.

Many young people are lucky. They have parents, teachers, and guidance counselors to steer them toward the right courses. But many students are not so fortunate. They desperately need adult role models and mentors to help them see a future beyond high school.

Parents of many students leave the decision of what to study in high school to their sons and daughters and the school. Busy making a living, they trust the school to do right by their children. With many high schools, this is a big mistake. Large comprehensive high schools, with many levels of watered-down academic content, give the "other" students complete freedom to choose courses that lead nowhere. No one should be surprised if a 14-year-old student who lacks guidance from parents, teachers, and counselors tries to beat the system by pursuing an easy way through school.

Guidance counselors in many high schools acts as "sorters" to decide which students enroll in challenging academic studies and which ones take low-level courses. Too often, the decision is based on socioeconomic factors and past school performance rather than what students are capable of doing when challenged. Much of the nation's talent is wasted because of curriculum and

guidance systems that accommodate low expectations and low achievement. SREB found that vocational completers who received advice about math and science courses from school guidance counselors scored significantly lower than students who listened to others or made up their own minds (see Table 36).

Effective Guidance and Counseling

Students who don't see a connection between high school and future success are doomed to spend their school years in a "neutral" position. The way to turn on turned-off students is to help them understand the role of high school achievement in reaching their goals in life as well as for education and employment. Students should be reminded that studying hard in high school gives them discipline and strength to cope with whatever the future brings. High schools that fail to expect very much communicate to students in a thousand different ways that their lives are worthless in the larger scheme of things.

The truth is that students have responsibilities to society—to develop their talents, to provide for themselves and the children they bring into the world, and to pass along to the next generation a set of worthwhile values and accomplishments.

TABLE 36

Persons Influencing Selection of Math and Science Courses, and Corresponding Average Scores

National Assessment of Educational Progress (NAEP) Results
for 1990 SREB Pilot Site Vocational Completers

	PERCENT	AVERAGE	
		Math Score	Science Score
Counselors	23%	287.3	260.4
Mom/Dad	16%	291.8	269.3
No one	44%	291.7	269.0
Others (teachers/friends)	17%	290.9	263.5

Counselors and teachers have an obligation to help the "other" students realize that a lot will be expected of them in the future and that they need to make the most of their high school years.

To be successful in integrating academic and vocational education, high schools must:

- ✓ Replace the general track with one that requires students to complete an upgraded program of academic study with a vocational or academic major. Guidance counselors are handicapped greatly in their capacity to help students when high schools give students access to low-status academic courses.
- ✓ Assist non-college preparatory students in planning a program of academic and vocational study. At least two of the three science courses SREB recommends should be directly related to vocational studies.
- ✓ Assist with scheduling to make sure students with similar vocational interests—for example, technology, health sciences, and business—have the same English, mathematics, science, and vocational teachers. This enables teachers to work together to integrate academic and vocational instruction. Through scheduling, a counselor can help make sure teams of academic and vocational teachers at each grade level have students in common. This allows a small group of teachers to plan ways to increase students' achievement.
- ✓ Have ample guidance personnel with time and resources to meet the needs of all students, including the many boys and girls who plan to work and/or attend a local community or technical college after high school. Counselors must find ways to concentrate on the "other" students to the same degree they have supported the goals and ambitions of college preparatory students.
- ✓ Help the "other" students meet higher standards in their studies. Too often, counselors who rely on preconceived opinions of students advise them to select weaker, rather than more challenging, courses.
- ✓ Guide "other" students to enroll in college preparatory level mathematics, science, English, and vocational courses that will strengthen their learning, prepare them for the future, and help them reach undreamed-of heights.

Parallel Paths Through High School

Guidance counselors must lead the way in developing parallel pathways through high school. The pathways can be compared to a dual-lane super highway leading into the future. Both lanes require students to master essential content of mathematics, science, and English. Students in one lane learn content through an applied method in academic and vocational classes, while students in the other lane learn in a more traditional way. The model is flexible, allowing students to change lanes along the way.

Interests and Aptitudes

The SREB Consortium believes that every young person has interests, aptitudes, and experiences that schools should recognize and reinforce. Sometimes, students look for encouragement at school when they cannot find it anywhere else. Counselors and teachers must take the time to discover the best in every student.

"If we don't expose students to math and science, how do we know if they are gifted and talented in those areas?" asks Henry M. Levin, director of the Center for Educational Research at Stanford University. Dr. Levin is a proponent of "accelerated" rather than remedial or slowed-down learning for students who have not done well in school in the past.

By the time students reach high school, they usually know the activities they like best. It is easy for a school to group academic and vocational courses around broad themes—for example, expression of ideals; fixing, designing, or making things; organizing and managing data and information; or working with people. By grouping students, a school can link their interests with academic and vocational courses and give students an opportunity to "try out" career activities without locking into a system that slams the door on future options.

Planned Efforts to Include Guidance Activities in the Curriculum

Most high school guidance programs have been derelict in providing the "other" students with opportunities to get what they

need to be successful at a community college or in a work setting. In interviews, 50 to 55 percent of graduating seniors completing a vocational program of study said they planned to continue their education after high school. Yet, most of the last-quarter seniors didn't realize they would have to take non-credit college courses for almost a year before taking a course for credit. One year after high school, about 50 percent of students who completed a vocational major had enrolled in further study, but about one-fifth of them had already dropped out.

Guidance counselors must insist that teachers build learning activities into the curriculum to show students the relationship between school studies and future career opportunities. Students who see a need for math and make the connection between studying math and getting a good job are more likely to score higher in math achievement tests. Clearly, the way to motivate practical-minded students is to show them how math and other challenging courses will benefit them in the future.

High School Counselors Need to Shift to a New Model

Norman Gysbers, professor of counseling education at the University of Missouri, says high schools must stop focusing on the "position" of counselor and the services traditionally provided, and begin thinking in terms of a comprehensive guidance program with far-reaching goals and objectives. Under the old system, a school counselor is solely responsible for guidance and counseling activities. The person who holds the position provides traditional services, such as orientation, counseling, and placement, and is often isolated from the rest of the staff and curriculum. Under the new model, the total school faculty is involved in guidance and counseling goals and activities. The counselor is a team member working with teachers through the curriculum to achieve certain student outcome goals.

Under the old system, the guidance counselor finds a comfortable place for the "other" students until they complete the 12th grade. Under the new model of integrating college preparatory content with vocational studies, the guidance goal is to help the "other" students complete a vastly upgraded program of academic study with a vocational emphasis.

Counselors and teachers at several SREB sites are cooperating to deliver a comprehensive guidance program that meets the needs of students in general and vocational programs of study.

Here are ways they are collaborating:

Curriculum-Based Guidance Activities

- ✓ Academic and vocational teachers use instructional methods to help the "other" students see the correlation between school learning and job performance. A special effort is made to help students understand that employers will expect them to be able to write clearly, solve multi-step math problems, and use science and technology to know why things work.
- ✓ Beginning as early as the eighth grade, the counselor schedules class time to help students examine education and career options.
- ✓ Counselors and teachers work together to help the "other" students understand the possibilities for further study beyond high school.
- ✓ Middle and high school teachers and counselors cooperate to help the "other" students see a connection between high school and the future.

Individual Planning

- ✓ Interest and aptitude tests in the lower high school grades help students identify broad career fields of study.
- ✓ Counselors, administrators, and specially trained teachers meet with students and their parents annually, beginning in the eighth grade, to plan an upgraded program of academic and vocational study.

Responsive Services

- ✓ Counselors spearhead an information campaign to help students and their parents understand the need for a more challenging program of study.
- ✓ Counselors meet with teams of teachers to identify students who need extra help in an upgraded program and the types of help to be provided.

System Support

- ✓ Counselors revise the high school handbook to give students examples of an upgraded program of study needed for success at work and in higher education.
- ✓ Counselors prepare information to help students see the connection between courses they take in high school and their progress after graduation.
- ✓ Counselors provide materials and access to computer systems to help students relate their interests and aptitudes to various job possibilities and the academic and vocational preparation those job fields require.

The Woodland Experience

All students at Woodland High School in California have specific career paths their counselors, teachers, and administrators help them follow. In this total school effort, students graduate from high school with a clear vision of what they want to do in life and with the academic and vocational knowledge and skills to help them achieve their goals.

Planning begins in junior high and intensifies as the students move through three years at Woodland. When they graduate, the students have a portfolio of career-related information such as a career interest research paper, a personal resume, and sample job applications.

Regardless of whether they are planning to work or attend a four-year college or university, students select a cluster of courses in one of six broad occupational fields:

- Agriculture and Natural Resources
- Arts and Communication
- Business and Marketing
- Health, Home, and Recreation
- Industrial Technology and Engineering
- Social, Human, and Governmental Services

As a result of having focus and purpose through the Career Opportunity Paths in Education (COPE) program, students achieve at a higher level and are less likely to drop out before graduation (the dropout rate has declined 38 percent).

"In the past, counselors tended to focus on the problems rather than the possibilities of young people," says Evelia Genera, chairman of Woodland's counseling department. "Our emphasis is on helping students plan for life and in giving them skills they will need to cope with life's problems."

In this school of 1,600 students located near Sacramento, a six-person counseling staff manages to schedule two small-group pre-registration conferences and at least one individual conference with students each school year. One counselor is assigned to work with all students in a particular career path.

Students can switch from one path to another if their interests change. Since everyone must meet basic graduation requirements, the flexibility is in choosing electives. "A business student may decide he likes working with people and wants to become a social worker," Ms. Genera said. "He notifies his counselor at the pre-registration conference, and the counselor helps him select new electives more in line with what he wants to do."

Counselors visit classrooms frequently to talk with students about their education and career plans. After each presentation, the teacher assigns a project that is related to the topic and to the students' career paths.

Teachers work closely with the counselors to provide students with frequent and meaningful examples and projects from real life. After a steering committee of teachers, counselors, and administrators asked all teachers to develop work-related activities, counselors collected the activities in a notebook for teachers to consult when they need ideas. The counselors often suggest ways teachers can make academic courses more relevant to what students aim to do in life.

To give counselors more time for career planning, Woodland contracted with community resource agencies to help students deal with social and emotional issues such as grief or drug use. "We still handle problems that arise, but the agencies take care of on-going counseling," Ms. Genera said.

Another aspect of planning is the high school's contact with students in the eighth and ninth grades. Counselors from

Woodland work with counselors at two feeder schools on programs such as "Wake Up Call," an awareness program to alert eighth grade students to the need for early planning for education and career. Individual counseling sessions with students and parents begin in ninth grade.

Students enter Woodland as sophomores. They take an interest inventory test and register for courses in a chosen career field. To complete a career interest research paper for an English grade, students find information on educational and skill requirements, job opportunities, and salaries in the career they hope to follow. They also interview people in that occupation or profession.

A computer enables the counselors to keep track of their contacts with students. The date and nature of each conference is entered into a computerized permanent record for easy reference in talking with students or parents.

The Counselor's Dilemma

To be effective, counselors must gain the confidence of students, a process that can take a long time. Many guidance counselors who are committed to helping the "other" students are concerned with the number of hours spent scheduling rather than counseling. Remaining hours are dominated by crisis counseling to solve an array of student problems, rather than by education and career counseling.

Another responsibility of guidance counselors is to be up-to-date on trends in business and industry, including new and evolving occupations and current job placement opportunities. Counselors must develop and constantly update programs and materials to orient students, parents, and teachers to the changing nature of the workplace and the increasing demands of higher education.

The guidance staff will never have enough time or manpower to be all things to all students. The task of getting every student ready for the future is monumental. Only by coming out of isolation and enlisting the help of all teachers will counselors be able to multiply their efforts and help create a school curriculum and environment to reach every student.

A Four-Year Educational Plan

Increasingly, counselors and other educators are realizing that a coordinated plan, implemented no later than the eighth grade, is the way to prepare students for work and further education.

The State of Florida piloted a program in 1991-92 that encompasses all elements of an effective four-year educational plan. Called "Pathways to Your Future," the program helps students set education and career goals and develop ways to achieve them.

The Florida program is introduced to students in middle school. Working in small groups, students enter personal and career information into individual workbooks. The information helps students pinpoint their interests and aptitudes and develop a high school plan based on education and career goals.

Students provide background data, which is scanned into the Florida Computer-Assisted Career and Education Planning System. Each student receives a computerized report containing current occupational information and sample high school plans. The plans include courses offered in the student's high school which are appropriate for the student's career goals. This information is a valuable resource for counselors as they sit with students and parents to map out a four-year educational strategy.

The program is plotted using a Career and Education Planner. The plan is kept at the high school and reviewed by the student and counselor each year to determine progress. Students can take their plans with them when they graduate.

Randolph County, West Virginia is another site using the educational planner concept. A student's Career and Educational Planning Folder provides a blueprint for four years of study that can be adapted if the student's interests and goals change.

The folder has four sections. Section I is devoted to "Facts About Me," helping students learn about themselves. Section II deals with career clusters and specific jobs within each cluster. Students are encouraged to set several career goals to keep their options open. Section III helps students identify educational requirements for specific jobs. In Section IV, a student's four-year high school plan is outlined. The plan calls for an understanding of various certificates of achievement offered in the county. Students are able to see how changes in their goals and aspira-

tions affect their educational plans. The folder is reviewed each spring and revised as needed.

Project Destination at Walhalla High School in South Carolina gives students an early start and guides them throughout high school. Two guidance specialists coordinate a comprehensive program to expose students to a wide range of education and career information. Activities include field trips to companies and college campuses, opportunities to "shadow" someone in a real job, an in-school video telecast system, speakers from the community, career awareness sessions, and assistance in using the school's education and career information center.

Student profiles are developed at the middle school level and updated yearly throughout high school. The profiles include interest and aptitude inventories, standardized test scores, scholastic scores, and other information judged helpful in providing career direction.

Walhalla has two curriculum paths: a four-year college path and a two-year technical college path. Students enroll in one of a number of specific occupational programs when they select the technical path. The plan is flexible enough to allow students to change paths along the way.

Walhalla believes the new direction will bring a number of positive results:

- Higher-achieving students with greater expectations;
- More students blending complex academic and vocational studies;
- A closer working relationship between middle school, high school, and the career center;
- Coordinated programs involving the high school, the career center, and postsecondary technical schools.

Claiborne County, Tennessee has made a concerted effort to develop four-year plans for all its students. The counseling staff begins the process in eighth grade by helping students see the relationship between education and future earnings. All students take aptitude and career interest tests to determine appropriate directions for their education. The tests are followed by a parent and student visit to the high school to learn about course offerings.

The final step is a conference with parents and students to discuss test results, the school's education programs, the student's plans after high school, and the student's four-year plan. Many parents are involved in the program to help their children develop a challenging program of academic and vocational study.

Pontotoc County, Mississippi is working to involve more parents in a four-year planning process. Students who plan to attend the county vocational center are encouraged to plan early so they will meet all entrance requirements for the Tech Prep program developed jointly with the local community college.

Only about 20 percent of parents and students in the Pontotoc school district attended planning conferences at the school when the four-year plan went into effect. By the third year, the total had jumped to 85 percent, spurred by more publicity for the planning process, calls to parents from the principal, and an evening conference schedule.

The program's success was aided by agreements between the local community college and high school vocational centers. Students who attend the vocational center may receive advanced college placement for proficiency in certain areas of study, an attractive benefit to parents and students as they face escalating college costs.

Parent and counselor involvement is credited with a rise in the number of students in Pontotoc County taking more high-level mathematics and science courses.

Student Handbooks

Explaining stiffer requirements to students and parents is a critical dimension in implementing a revised program of study. Many SREB schools have developed new, more informative student handbooks to detail new approaches to the curriculum. The handbook at St. Mary's County Public Schools in Maryland is a comprehensive compilation of everything students and parents need to know about graduation requirements and course selection. The guide provides information on:

- Parallel pathways through high school—Tech Prep and college prep;
- Graduation requirements for each pathway;

- State-required competency tests;
- Student placement;
- Grading system;
- Advanced placement program;
- How to make schedule and program changes;
- Descriptions of the system's four clusters of study;
- Course descriptions;
- State university admission requirements;
- Guidelines for independent study and school-community service within the school day.

Walhalla High School introduces students and parents to a new curriculum through *Career Bound*, a guide to help plan a challenging and connected program of academic and vocational study, and *Success by Design* brochures outlining curriculum options.

Rockbridge High School in Fairfield, Virginia, provides students and parents with a booklet of information on course offerings, policies, requirements, and services. The handbook stresses that employment and college admission are highly competitive, noting that the quality of subjects studied and the caliber of educational performance are critical factors in whether the student is hired or accepted.

The Importance of Involving Parents in the Guidance Process

The amount of encouragement and support children receive at home can make the difference in whether they set their sights high or settle for "getting by."

"Parents have been miseducated about their role in educating their children," Henry Levin says. He encourages schools to involve parents in reinforcing the need for students to have a strong background of academic and vocational education to meet increasingly demanding workplace requirements.

In an ideal situation, parents join with teachers and counselors to inspire students to greater heights of achievement. They attend parent conferences, have a say-so in the child's four-year plan, and provide the child with examples of how new technology re-defines jobs and careers.

In reality, many parents may not be aware that their children are taking courses below their potential. "The child may be the first in the family to graduate from high school, and the parents are happy if he or she simply stays in school," one counselor said.

Other parents know that their children should take tougher courses, but they want to protect them from the possibility of failure. "Who is going to protect these students after they miss an opportunity to learn in high school and can't find a decent job in the future?" another counselor asked.

In *The Evidence Continues to Grow: Parent Involvement Improves Student Achievement*, Anne Henderson of the National Committee for Citizens in Education reports key findings about parent participation in a child's education:

- Involving parents in a son's or daughter's education improves achievement.
- Parental involvement is most effective when it is comprehensive, long-lasting, and well-planned.
- Parental influence is still strong in the high school years and beyond.
- Parental involvement must not be limited to the home. Parents must take an active role in the school at all levels.
- Young people from low-income and minority families have the most to gain from parental involvement. Parents do not have to be well educated to make a difference.

Schools doing the best job of guiding students to make sound educational decisions are fully aware of the importance of "selling" parents and students on the importance of a dual purpose program of study. The Parent Institute in Fairfax Station, Virginia has a checklist of strategies teachers can use to involve parents in education and career planning (see next page).

What Teachers Can Do to Involve Parents

Here is a checklist of strategies teachers can use to encourage parental involvement:

- ☐ **Know the secret to getting parents to attend meetings at school:** Invite them. Most parents do not feel welcome at school. They are reluctant to attend school activities because they often feel teachers don't really want them to come. And studies show parents are right! To get parents out, make an effort to genuinely invite them. A handwritten "hope you can make it!" on the printed announcement may do it. Mentioning the upcoming program every time you see parents in the community or talking to them on the phone will also help spread the word in a compelling way.
- ☐ **Recognize the natural, human reluctance teachers have to contact parents.** Studies show that teachers are more reluctant to contact parents than parents are to contact teachers. Work to overcome the problem by getting to know parents as people who care about their kids.
- ☐ **Use videotape to show busy parents their students in action.** Send tapes home. Show them while parents are waiting for conferences. This is a video age and showing parents their children in action in their school habitat conveys powerful messages.
- ☐ **Hold several open house programs throughout the year, including visitation days and unrehearsed regular days where parents can see a real class in action.** Particularly with the skepticism many parents still have about vocational education, getting them into the classroom to see firsthand the exciting, practical things that go on there is a powerful way to build support. Again, a genuine invitation is the key to good attendance by parents.
- ☐ **Display students' work**—every student's work, not just the best students' work.
- ☐ **Greet visiting parents as quickly as possible.** You might use volunteers to help.
- ☐ **Know the major reasons parents give for not getting involved:** 1. Don't have time. 2. Don't know what to do. 3. Don't think it is important. 4. Don't speak English. Knowing the barriers is the first step in finding ways around them.
- ☐ **Announce that you will hold informal coffee times at school on a regular schedule and encourage parents to drop in whenever they can.**
- ☐ **Establish and use parent advisory groups.** Parents will participate and help if they feel genuinely wanted, welcome, and needed.

- ☐ **Don't wait until it's too late to give parents bad news.** If you see a problem developing, contact parents fast—while there's still hope.
- ☐ **Share with parents experiences you have had with your own children.** This breaks down barriers, gets you out of your teacher role, and helps parents see you as a fellow parent.
- ☐ **Recognize what parents are doing to help students—praise them for their efforts.**
- ☐ **Use simple evaluation forms to elicit parent feedback on every meeting or event.**
- ☐ **At group meetings with parents, never ask questions where there can be wrong answers.** Nothing will better ensure that parents never come back than being embarrassed at a parent meeting.
- ☐ **Tap the vast parent resource pool every school has—**parents who have lived overseas, who speak other languages, who have jobs that use skills schools are trying to teach students, who have hobbies that fit into the curriculum.
- ☐ **Get parents out with projects that call on their special abilities by asking them to be speakers, and with other incentives, such as raffles.**
- ☐ **Take parents' pictures at group functions.** Tell them in advance that pictures will be taken with their student, and prepare for a crowd.
- ☐ **Put up a "Welcome" sign in every language spoken by students and parents at your school.** Ask parents' help to get the words right.
- ☐ **Establish friendly contact with parents early in the year, in time of peace before there is any opportunity for anyone to be upset with anyone else.**
- ☐ **Set up a parent center in your school.** Stock it with resources to help parents.
- ☐ **Consider designing learning contracts you can use to involve school, parents, and student.**
- ☐ **Encourage businesses to provide parent employees time off to attend school conferences.**
- ☐ **Remember that hard-to-reach parents can often be reached through their churches.**

The Parent Institute

Trigg County High School in Cadiz, Kentucky, attracted 95 percent of eighth grade parents to an evening orientation and counseling session and almost that many to annual parent-teacher conferences. The school uses news media publicity, a quarterly newsletter, and phone calls and letters to parents from teachers to achieve a high level of participation.

The Role of Academic and Vocational Teachers in Guiding Students to Better Choices

Faced with student-counselor ratios that make frequent, effective one-on-one counseling impossible in most schools, many counselors invite academic and vocational teachers to become partners with them in the counseling process. Teachers and counselors serve together on curriculum committees to upgrade the school's program of study, and they participate in business and industry tours to see firsthand what students will need in the future. Individual teachers urge their students to enroll in more challenging courses in mathematics, science, and English, and help students bring special talents and abilities to the surface.

- ✓ The faculty at Woodlawn High School in Shreveport, Louisiana have made a special effort to build bridges connecting the school, the business community, and the home. Woodlawn's Business Academy students create, name, market, and sell motor oil and other products that bring them into contact with business professionals and customers. Teachers at other schools can encourage this type of project to increase communication and understanding between the school and the community.
- ✓ Swain County High School in Bryson City, North Carolina, has a multi-faceted program for involving parents and students in formulating four-year plans. Counselors, administrators, and teachers sponsor an open house for eighth grade students and their parents to develop individualized plans; counselors review plans with students twice a year; counselors and administrators publicize the planning process in literature, letters, newspapers, and at school; and teachers use the DISCOVER program in grades 9 through 12 to increase career awareness. Swain County High involves the business community in career selection, and uses formal and informal career assessment techniques.

- ✓ Counselors in the Phenix City, Alabama, school system help students and parents understand ninth-grade interest and aptitude tests, help students develop a four-year plan, invite parents to review and approve the plan, emphasize the importance of following a plan, explain the Tech Prep option, work individually with students to register them for courses that support education and career goals, and work individually with Tech Prep students to coordinate their high school studies with further education.

Summary

The SREB Consortium creates a school environment in which teachers, counselors, and administrators focus on all students as individuals with unique experiences and capabilities and the potential to be successful if they plan wisely for the years ahead.

Guidance counselors at SREB schools are emerging as standard-bearers for early academic and career planning involving the "other" students and their parents. Counselors are leading the way for all students to look ahead and do what is necessary in high school to prepare for success at work and in further study.

In doing so, counselors are forming new alliances with teachers and administrators and becoming an integral part of the school team. It takes a combined effort schoolwide to make curriculum changes and guide students into more challenging academic and vocational studies.

Counselors who make a difference keep in close touch with the world of business and industry to be able to help students set their sights high and select a coordinated program of study that will help them reach their goals in life.

Chapter 8

EXTRA HELP FOR TEACHERS

Teachers are the essential element in creating high schools that work for students who do not plan to go directly to a four-year college or university. Teachers can make a real difference in the lives of students, by working cooperatively with other faculty and by implementing new and different ways to cultivate higher-level learning.

To accomplish what they want or are asked to do, teachers must have the encouragement and support of administrators at all levels. Superintendents, principals, and school board members must send a clear signal that change is needed. They must allow teachers the flexibility and authority to make changes and must help them break the traditional boundaries. They must provide time, materials, and staff development, and must help strengthen ties with business and industry and higher education.

As one teacher said, "We need help and support from the principal and the central office to give general and vocational students the education they deserve."

Areas Where Teachers Need Extra Help

A survey in 1990 of more than 1,000 academic teachers and more than 700 vocational teachers from 38 SREB pilot sites revealed a number of areas where teachers need materials and staff development to help them advance the communication, mathematics, and science competencies of high school vocational completers. To seriously undertake the implementation of SREB's Key Practices (Chapter 1) for integrating academic and vocational studies, teachers need staff development that includes:

Reading and Writing for Learning—About one in four of the academic and vocational teachers surveyed does not assign a writing project of at least one page during a typical month. About one in three teachers normally does not include essay questions on exams. Teachers who do not make writing assignments are

failing to use writing as a way to help students organize knowledge and improve writing skills within a subject area.

Even though six of 10 academic and vocational teachers surveyed believe it is important to have students read and write for learning, only one in four teachers feels prepared for it.

Only one in 10 teachers reported that the high school provided a great deal of professional development in getting students to read and write for learning academic and technical content. Only one in three academic teachers and one in 10 vocational teachers had college pre-service training that prepared them to help students read and write to master subject matter.

School systems should provide staff development to help teachers use reading and writing skills to promote students' mastery of academic and technical content, and to help all teachers use reading and writing for learning across the curriculum.

Mathematics Skills and Strategies—Six in 10 academic and vocational teachers believe it is important to teach mathematics in an applied or occupational context, yet only one in three reported knowing how to do it well. Only one in 10 teachers said the school system provided a great deal of preparation in using applied learning methods in mathematics. Only one in 10 academic teachers had pre-service training in using applied learning techniques in mathematics instruction, while only one in 10 vocational teachers felt capable of incorporating math skills into vocational courses.

School systems should offer staff development to help teachers improve the mathematics knowledge of students in general and vocational studies:

- Vocational teachers need help in relating complex math concepts to their vocational fields and in incorporating math concepts into instruction.
- Mathematics teachers need help in applying math concepts to a variety of work settings and in using a more practical approach to teach complex mathematics concepts.
- Math and vocational teachers need help in understanding the importance of integrating complex mathematics concepts into the vocational curriculum and in using a real-world context to teach math concepts.

The Link Between Science and Technology—Academic and vocational teachers need to understand the close connection between science and technology. Only one in 10 vocational teachers and five in 10 academic teachers believe it is important to teach science concepts in an applied or occupational context; only two in 10 report that they can do it well. Fewer than one in 10 receives any staff development from the school system.

School systems should offer staff development to help teachers improve the science and technology skills of the "other" students:

- Vocational teachers need help in relating underlying science concepts to vocational fields and in integrating the concepts into instructional programs.
- Science teachers need help in relating science concepts to various vocational and occupational fields and in teaching science concepts through authentic vocational experiences.
- Vocational and science teachers need help in understanding why it is important to integrate more complex science concepts into vocational instruction and in using real-world examples to teach the concepts.

Raising Expectations—Three in 10 vocational teachers report that they usually do not assign homework. Since the 1987-88 school year, only one in 10 vocational and academic teachers increased the number of tests and quizzes given, and only three in 10 vocational teachers and two in 10 academic teachers increased what they expect from students. In establishing and helping students meet high expectations, only three in 10 teachers received any preparation from the local school system. Academic and vocational teachers need staff development on the benefits of raising expectations and helping students achieve at a higher level.

Team Building—Vocational and academic teachers need team building skills and time to plan and work together to integrate academic and vocational studies. Two in 10 vocational and academic teachers report that since the 1987-88 school year they have spent much more time working together to coordinate academic and vocational instruction. This increase is reflected in the fact that three in 10 teachers say they have made much more effort to revise their curricula and that two in 10 academic teachers report much more time devoted to applied learning

strategies. Yet, three in 10 vocational teachers and six in 10 academic teachers report they do not meet together to make plans for improving the academic achievement of the "other" students. Only one in 10 teachers says the school system offers preparation for team teaching. Vocational and academic teachers need staff development in team-building skills and the benefits of working together. More importantly, they need a staff and school organization and scheduling that make it possible to work together.

A 1990 survey of academic and vocational teachers revealed that only 12 to 15 percent had received a great deal of staff development in how to use applied or occupational methods to teach complex academic competencies. Many of the teachers were trained at state-sponsored summer institutes.

During the first two years of the *High Schools That Work* program, the staff development strategy at most SREB schools was to train potential teacher leaders and to expand the core group of teachers who were aware of program goals and Key Practices.

As a result, another 15 to 20 percent of academic and vocational teachers in the 1990 survey reported an interest in more in-depth staff development on Key Practices (see Table 37).

A Clear Signal Needed from School Administrators

Administrators have an important role to play in helping teachers understand the plight of career-bound students, who face a world of burgeoning technology with an often inadequate background in mathematics, science, and English. Administrators can help teachers realize that the vast majority of students in vocational and general programs can learn more challenging content if it is presented through practical, hands-on learning activities.

Some teachers are skeptical, wondering if the integration of academic and vocational education will be just another ripple in the educational waters. Administrators must demonstrate commitment and convince teachers that this effort is permanent and that it will be pursued with depth and quality.

TABLE 37

**1990 Personnel Survey Findings on Level of Interest
of Vocational and Academic Teachers in Having
School-Focused Staff Development on SREB Key Practices**

STAFF DEVELOPMENT ACTIVITIES	VOCATIONAL TEACHERS	ACADEMIC TEACHERS
Adopting teaching methods to learning styles of different students	17	19
Teaching mathematics in an applied or occupational context	14	9 *
Teaching reading, writing, and speaking in an applied or occupational context	17	13
Teaching science in an applied or occupational context	17	8 *
Working with other teachers in team teaching	16	15
Establishing higher expectations and assisting students in achieving them	12	14

* The low number of responses to this question is due to the fact that English and social studies teachers do not see a role for themselves in mathematics and science. It is projected that this response represents about 30 percent of the mathematics and science teachers.

Some schools, particularly large high schools, have so many initiatives that teachers may find it difficult to see the connection between the SREB *High Schools That Work* program and other initiatives. As a practical matter, most of the other initiatives are related in some way to one or more Consortium goals for improving the achievement of the "other" students.

The SREB program is not just another add-on, stand-alone initiative. It provides a sturdy framework for "whole school" change—the kind of change that must take place to improve the achievement and potential of career-bound students. Administrators must help teachers find time to study the Consortium goals and strategies and devise ways to bring about full-scale implementation.

As evidence of their support, many principals and superintendents accompany their teachers to the SREB staff development conference each summer. This says to teachers that the Consortium program is important and that it is something the system and the school intend to undertake with determination.

An educational change of this magnitude does not happen overnight. When St. Mary's County Public Schools in Maryland eliminated the general education track and moved toward offering an upgraded core in mathematics, science, and English, administrators made it clear that the process would continue over a long period of time. Principal Edward F. Fitzgerald was candid when he said, "This is a five-year process. It involves moving 9th grade students through high school as we follow the new plan."

Teachers must be constantly challenged to discard the belief that the "other" students are too immature to do reading homework assignments or to return textbooks they take from the classroom. Teachers must be challenged to create a curriculum based on the belief that the "other" students can do "intellectual work" in mastering the essential content of the college preparatory curriculum.

Giving Teachers Authority and Flexibility to Solve Problems

Teachers must have opportunities to design or adopt new curricula and incorporate new teaching methods to bring about a major philosophical shift in the way they relate to students and other teachers. They must be allowed to rearrange what they teach, how they teach, and what they expect of students.

Valerie Truesdale, former principal at Swansea High School in South Carolina, believes the best way to make changes happen is to involve the teachers actively. "The experts are right there in the classroom," she says. Teachers need to feel ownership of new ideas and strategies, and the way to give them that feeling is to let them help research the problems and devise the solutions.

Teachers from the Sussex County Vocational-Technical District in Delaware brainstormed and made the initial recommendation to increase high school graduation requirements in the district. The recommendation developed during a four-hour, after-dinner meeting of a team of 12 teachers and three administrators at the SREB staff development conference in Florida in 1991. The purpose of the meeting was to share what team mem-

bers learned in presentations and workshops earlier in the day. "The administrators listened as the teachers began to piece together everything they had heard and to discuss the need for Sussex students to study more math and science," recalls district superintendent Dr. George Frunzi. The outcome of the meeting was a commitment to raise the graduation requirements. The plan was approved by the entire faculty at a three-day retreat the following month and by all members of the local school board a few weeks later. The new requirement took effect in the fall.

"We must listen to our teachers," Dr. Frunzi said. "What they say is creative and important."

Unlocking Teachers from the Existing System

Many teachers are satisfied with the status quo. They don't see a problem with the high school education of the "other" students, even though 40 percent of first-time entering freshmen at two-year community colleges must enroll in developmental studies to acquire basic academic skills they didn't get in high school. Many teachers fail to grasp the fact that the quality of what these students were taught and how they were taught is probably the reason most of them are having to take extra courses—at their own expense and usually without college credit—just to reach college entry level.

Academic teachers often fail to see why students in general and vocational programs should enroll in higher-level mathematics, science, and English. "I really don't see why general and vocational students should study geometry," one teacher admitted. Math and science are the basis for many vocational fields, while reading and communication skills are essential for success in any career. As technology advances, workers need better education and training just to keep pace.

Large high schools in particular are prone to divide the curriculum into narrower and narrower levels so that they can fit students into niches according to perceived ability. It is easier to sort curriculum content into levels and to teach the same old content in the same old way if students are grouped by what they did in the past.

Schools that eliminate the general track and the practice of assigning students to tiers according to past performance are finding that the "other" students can master college preparatory

level courses in math, science, and English. This is particularly true when teachers use the applied method and offer help before, during, and after school.

Teachers can widen their vistas by visiting other classrooms and other schools and by attending workshops and conferences to gather new ideas. When Swansea High School in South Carolina began its focus on integrated academic and vocational education, the principal concentrated on "unfreezing old attitudes" by sending teams of teachers to events inside and outside the state. "After we returned from the SREB conference in Oklahoma, we heard about a school in North Carolina that was moving in the direction we wanted to go, so I sent a team of teachers there," she said. Teams of teachers continued to attend meetings and conferences and listen to presentations and audiotapes as they searched for ways to restructure learning for students in general and vocational programs. "I told our teachers to bring back the best ideas, put them in the hopper, let them cook for awhile, and then create the best plan for Swansea High School," she said.

Meanwhile, the principal photocopied articles on cooperative learning and other topics from newspapers, magazines, and journals, passing them along to the faculty with a note at the top that read, "For your growth."

Another way to unlock teachers from the current system is to encourage them to do their own research on the impact of applied academic courses on achievement. How does applied mathematics, for example, compare to other math courses in the amount of knowledge a student acquires? This is one of the questions teachers can help answer through research and observation.

Faculty should be involved in studying data on the growing requirements of the workplace and of higher education. Teachers cannot afford to be "out of touch" with business and industry.

A group of 56 teachers, administrators, and counselors at Walhalla High School in South Carolina boarded buses in January 1992 for a schoolwide in-service day at local manufacturing plants that produce sportswear, battery casings, and electric meters. At midday, the manufacturers sponsored a luncheon to give the staff and faculty an opportunity to talk with company representatives and with each other about what they were experiencing on the tour. Many teachers had never visited a high-tech industrial setting to see firsthand the knowledge and skills required of today's workers.

"As a result of the tour, our teachers are able to explain to students why they will need advanced communication, mathematics, and science in the workplace," said Principal John H. Hostetler. In follow-up meetings at the school, teachers discussed how to use their new knowledge in the classroom. "Some teachers incorporated practical examples into their lesson plans for the first time," Hostetler said.

The tour was initiated by the school improvement council, headed by a prominent businessman, who invited local industries to participate. Details were coordinated by the school's staff development committee.

Teachers need time and opportunities to collect information from employers, college and university personnel, and former students about what high schools should do to prepare students to work and learn in the future. Teachers should determine what their former students are doing and whether they are successful. "It was very disturbing to discover that some of our students were not doing well in jobs and careers because they had not received a good academic foundation in high school," one teacher said. Teachers should not have to read in the newspaper that a former student feels his high school days were wasted because he was not encouraged or required to take tougher courses.

A school-developed survey of technical students at Floyd S. Kay Vocational-Technical Center in Lexington, Virginia, told teachers that they were not strict enough in requiring students to read, write, and do homework and that they were not incorporating enough math and science into technical studies. As a result of having the information, the faculty and administration created new, more rigorous instructional requirements, including:

- Students must read related classroom material at least 15 minutes a day and must complete a weekly writing assignment of at least one page that is collected, reviewed, and graded.
- Students must make two oral presentations annually before an audience of their classmates.
- Teachers must demonstrate math and science applications in each program at least once a week.
- Students have more homework, which is graded and returned.

"When we repeated the survey with the same students six months later, the results showed big gains in how much students were reading, writing, communicating orally, and being exposed to math and science," said principal Scott Hannah. "Our teachers saw that if they emphasize certain things in class, it does make a difference."

The most successful SREB sites have been able to unlock teachers from the existing system of low expectations, low-level content, and traditional instructional approaches. Successful schools give teachers freedom to examine new ideas and to design new systems based on high expectations, complex content, meaningful learning activities, and greater student effort.

Reorganizing the High School Curriculum and Schedule

Teachers need help from principals and other administrators to change the organization and structure of their school. They need time with each other and with students to make an impact on achievement.

Schools are making special efforts to carve planning time from the daily schedule. Some schools have added a 7th period for that purpose. Others have switched to a common lunch period for all teachers so they can meet in groups to plan practical learning activities for the students they have in common.

Successful SREB sites have created an environment of ongoing communication between academic and vocational teachers. Schools such as Rockbridge High School in Virginia take their teachers on a summer retreat to set the stage for continuing conversation and cooperation. Other schools provide opportunities for academic and vocational teachers to talk and visit throughout the year.

George H. Copa, professor of education at the University of Minnesota and director of study for the project "New Designs for the Comprehensive High School," recommends the intimacy of a school-within-a-school for groups of teachers and students in large high schools. In "The Organization of the Comprehensive High School," Dr. Copa and his associates conclude that dividing students into smaller groups "allows students to feel connected to the school, develop more personal relationships, and pursue unique interests that lead to positive motivation and achievement."

The principal at one large SREB Consortium site agreed that if his school is to reach the Consortium goals, "We're going to have to take the time to break down into smaller units within the school."

In working together, teachers need some classes—for example, health occupations and science—scheduled back-to-back so they can coordinate lesson plans and give students more time on integrated subject matter. Principals can help find blocks of time teachers need for cooperative efforts. One principal described the situation this way: "We simply must find time for teams of academic and vocational teachers to plan together and work together. It has been my observation that when they do, the academic teachers get ideas on how to present complex academic content, and the vocational teachers get ideas on how to add emphasis to academic content."

Staff Development

The blending of academic and vocational education has brought new and improved teaching methods, such as applied academic learning, team teaching, and cooperative learning into high school classrooms. Schools must be prepared to make sizeable investments in support of new activities. Financial assistance for staff development is available from federal vocational allocations, state and local education funds, and private industry donations. The ability to change teacher practice and behavior is a major factor in whether a school is able to implement SREB's Key Practices.

Academic teachers need to infuse new techniques into their instruction. They must learn how to weave lively examples from work and life into their courses and how to organize students into small groups to complete a project.

"It's very beneficial to 'old-timers' to be able to share ideas and learn how other teachers cope with problems," one veteran physics teacher said.

Vocational teachers need staff development, too. Some vocational teachers lack the academic foundation necessary to reinforce mathematics, science, and language arts in vocational labs. One principal said, "Students know when their vocational teachers are not up-to-date on workplace requirements."

School-Focused Staff Development—A high school should have an active staff development committee, composed largely of teachers, to create and implement a site-focused staff development plan that is reviewed and updated annually. The planning and review process should include input on teacher needs, data on student achievement, the site action plan, goals and practices from the *High Schools That Work* program, feedback from teachers, and evaluation of staff development activities. The aim is to prepare teachers, administrators, and counselors to carry out their site plan and achieve the goals of the program.

Thirty-eight existing SREB pilot sites reported staff development activities in the 1990-91 school year that were related to Consortium goals and practices and to needs expressed by teachers. At 22 of the sites, over 80 percent of teachers were involved in staff development. About half of the activities were teacher-led and self-directed by either an individual or a group. The activities included:

- Twenty-eight sites excused teachers from regular classroom duties to observe outstanding practices in another classroom or school.
- Twenty-six sites provided academic and vocational teachers with a common time to meet and share ideas on how to better serve the "other" students.
- Twenty-one sites excused teachers from regular classroom duties to enable them to work with a team of academic and vocational teachers in developing an integrated program of study.
- Twenty-eight sites supported vocational and academic teachers in revising their curricula and developing instructional strategies to teach more complex academic competencies through occupational or applied methods.

As academic and vocational teachers become enthusiastic about applied methods and the potential of the "other" students to learn challenging material, they see the importance of belonging to an interdisciplinary team of teachers.

SREB sites also provided teachers with workshops and courses on Key Practices during 1990-91:

- Thirty-one sites conducted workshops on raising expectations and getting students to achieve higher standards through use of extra help, applied learning methods, and team teaching.
- Twenty-three sites provided academic and vocational teachers with workshops on reading and writing for learning in the content area.
- Eighteen sites provided vocational teachers with workshops on integrating mathematics into the vocational curriculum.
- Seventeen sites provided academic teachers with workshops on using applied learning strategies to teach higher-level academic content to the "other" students.
- Nineteen sites provided teacher and counselor workshops on helping students select and succeed in more challenging academic and vocational courses.
- Ten sites provided academic and vocational teachers with workshops on teaching higher-level mathematics to the "other" students.
- Nine sites provided academic and vocational teachers with workshops on teaching more complex competencies to the "other" students through vocational and academic courses.

One Successful School-Based Staff Development Program—Rockbridge High School and Floyd S. Kay Vocational-Technical Center joined the *High Schools That Work* program in 1988. Immediately, the high school principal and the vocational school director outlined a staff development plan for the next four years. While carefully designing the first activity, they collected information from teachers and students to assist in developing future activities.

These two school leaders realized that their teachers were conventional in what they taught, how they taught, and what they believed students could and could not do. They knew it would take a major effort to change attitudes, curricula, and instructional practices.

All academic and vocational teachers at the two schools attended a three-day retreat to learn about each other's courses and the strong academic connections that exist from one course to another.

Staff development activity became the keystone of success at the Rockbridge site, where vocational completers made significant gains on NAEP math, science, and communication achievement tests between 1988 and 1990.

Other Examples of School-Based Staff Development—Other staff development activities aimed at helping teachers integrate academic and vocational education include:

- ✓ Workshops or other events at a school or district site conducted during the school year or in the summer by a visiting consultant or a local trained teacher or administrator.

Lyman High School in Seminole County, Florida, sponsored a "technology fair" to acquaint faculty members with new technology that exists in and out of school. Teachers could register for classes in computers, closed circuit TV, and other electronic advances.

- ✓ Some SREB sites schedule weekend retreats. The local staff development committee identifies needed topics and plans one or more workshops for 25 to 40 academic and vocational teachers in a retreat setting. Workshop leaders are usually teachers or administrators from other SREB sites that have had success with the practices being addressed.
- ✓ Focused year-long staff development on a topic or topics. The *Reading to Learn* program at three SREB sites in Virginia is an example of staff development that works best over a period of months to give teachers time to implement techniques and receive feedback on how they are doing.
- ✓ Visits to other schools are scheduled for a variety of purposes. Teachers may want to observe new courses or new teaching methods as they develop curriculum for their own schools. Sometimes, teachers may want to get a better understanding of what goes on at the "other school" when students take academic and vocational courses on separate campuses.
- ✓ Teleconferences are a modern way to bring large groups together electronically to focus on specific topics. One example is technology education, the topic of a teleconference at Carencro High School and Lafayette Parish Career Center in

Louisiana. At the Claiborne County, Tennessee site, mathematics, science, and vocational teachers participated in a teleconference on using mathematics and science in industry.

- ✓ Business and industry experience helps academic and vocational teachers keep pace with new developments in the workplace. A company that employs a large number of new high school graduates is a logical place for teachers to discover firsthand the types of skills their students need. Summer programs are available or can be developed in conjunction with business and industry to provide teachers with apprenticeships, college credits, or stipends as they gain valuable experience in the use of computers, robots, and other technology.

Local business leaders are eager to share information about worker competencies by serving on school advisory committees, making presentations, and arranging tours of the work-site.

- ✓ Follow-up and coaching are important throughout the school year to reinforce what teachers learn in workshops and institutes and at meetings and conferences. Teachers need opportunities to discuss new activities and share ways to solve emerging problems.

Meeting Common Staff Development Needs Through State Institutes

Some states conduct institutes to assist *High Schools That Work* sites in implementing new applied academic courses. In Georgia, teams of math, science, and vocational teachers were introduced to Applied Mathematics, Applied Biology/Chemistry, and Principles of Technology (applied physics) at two-week summer institutes. Teacher educators at a four-year Georgia college designed the institutes, and the Georgia Department of Education underwrote the cost of sending three teams from each SREB site. Institute instructors were high school teachers who had taught the applied courses.

The teachers walked through most of the lessons from the applied courses and taught several lessons to their colleagues, who provided valuable feedback on instructional techniques. Working

as teams, academic and vocational teachers learned to rely on each other for support and assistance in incorporating new strategies and developing new materials for the applied courses.

As follow-up, the institute director phoned frequently and visited the teams to help teachers solve problems, fine-tune techniques, and alter materials when necessary. During visits to the sites, the director talked with the superintendent, the curriculum director, and the principal to increase understanding of the importance of teamwork by academic and vocational teachers.

State institutes promote formal and informal networking by academic and vocational teachers, who develop a wide range of resources—from institute directors to successful teachers in schools across the state.

Susan Gerard, applied mathematics teacher at Forest Park High School, attended the Georgia math institute with her vocational education teammate, Joanna Phillips of the business education department. As a result of the training, Ms. Gerard often consults with vocational teachers on how to present certain math concepts. "Before I set up an activity, I ask a vocational teacher for input," Ms. Gerard said. "I want to know if it is a good idea, what to emphasize, and how to improve the activity by making it more relevant to what students will be doing in life." Before she and her students installed a grid of wooden stakes and string on the front yard of the school to study angles, Ms. Gerard confirmed with a vocational teacher that "this is what construction workers actually do on the job."

Forest Park teachers who attended the math institute and similar summer workshops on Applied Communication and Principles of Technology (applied physics) meet at least once a month with the principal and the guidance counselor to discuss how academic and vocational courses connect. They also have opportunities to explain the new courses to other faculty members, including vocational and non-vocational teachers. "Overall, we've done a good job of integrating academic and vocational education," Ms. Gerard said. "It is no longer a case of teaching math in one building and vocational classes in another. The applied math labs are located in the vocational building," she said.

Multi-State Workshops and Resources

The SREB Consortium provides regular activities aimed at helping teachers integrate academic and vocational education:

- ✓ The annual Staff Development Conference provides a comprehensive program of expert national, regional, and local speakers; specialty sessions; workshops; focus groups; and idea sharing. Sites that send a full team of academic and vocational teachers and administrators to the conference have made the most progress toward integrating academic and vocational education.

The conference, which included more than 1,500 educators in 1992, gives school teams a chance to "get away." The teams develop a new perspective on accelerated learning for students in general and vocational studies. Many teams meet at night to share what they learn during the day and make plans for the future. "One of the biggest problems in education is the lack of time to sit and be creative," according to Susan Goldsmith, former principal of Pebblebrook High School in Cobb County, Georgia. When a team from Pebblebrook attended an SREB conference, members were inspired to remove the general education track and introduce new applied academic courses in the upcoming school year.

- ✓ SREB publishes an annual directory of teachers and principals who have demonstrated outstanding performance in implementing Key Practices to improve the achievement of students completing a vocational major. High school personnel are using each other's expertise to change high schools for the "other" students.

New Materials

Schools must be ready to invest in new materials to help teachers improve learning for students who don't plan to enter a four-year college or university. Materials may be purchased, or they may be developed locally. Applied learning courses from the Center for Occupational Research and Development, the Agency for Instructional Technology, and others often serve this purpose very well.

Vocational teachers need mathematics, science, and language arts materials to help them integrate academic subject matter

into vocational courses. Several schools have purchased special math texts to help vocational teachers explain the math principles in vocational subjects.

If schools develop their own materials, the investment includes time as well as money. It takes time to serve on curriculum committees, to search and find materials from other schools, and to develop local versions of applied courses. Teachers should be compensated for their extra endeavors.

Summary

High schools striving to improve the individual performance of students in general and vocational programs of study must have a community of teachers who set challenging goals and expect students to achieve.

Teachers know the present system is not working, and they are willing to make sacrifices to create schools that encourage high performance from students with low motivation. Teachers are eager to make changes if they know they have the involvement and long-term commitment of school leadership. Superintendents of SREB school systems making the most progress began by sending a clear message to teachers that they would support them in revising what is taught, how it is taught, what is expected of students, and how the staff organizes itself for change.

Most superintendents placed one condition on their support: the change had to increase the expectations and achievement of the "other" students. In essence, the administrators said, "We are unlocking you from actual and perceived restraints. Within reason, we will provide the time, materials, and staff development to support your ideas." This type of clear, unwavering direction and support is essential in giving teachers the confidence they need to move forward with plans to blend college preparatory academics with vocational studies.

HIGH SCHOOLS ARE CHANGING

Students in general and vocational programs of study are routinely denied the attention that college preparatory students receive. Many high schools severely short change the "other" students with a diet of unchallenging courses that fail to engage students' interests or enlarge on their knowledge.

If the high school years are a preview of life, as some observers believe, an alarming number of young people who wander through the high school curriculum are destined to spend their lives "just getting by."

America is struggling to keep pace with economic growth around the world. Technology at home and abroad is changing rapidly, and United States students lag behind students in other countries in mathematics and science, the academic subjects most closely aligned with technology. If workers cannot apply the principles of mathematics and science to the work setting, they are unlikely to succeed in modern occupational environments.

Pleas From Business

Leaders of business and industry plead with high schools to send them workers who are well-grounded in English, mathematics, and science. They want employees who can read a technical manual, write a report, communicate with supervisors and co-workers, and make wise decisions.

Many educators do not believe students in general and vocational programs can master more difficult courses, and many counselors are too busy helping college preparatory students get into four-year colleges and universities to pay attention to students who plan to get a job or enroll in a local community college after high school.

Some school systems insist on hanging onto the general academic track, a convenient way to group students who are content to take an easy ride through high school. The general track is often used to distribute students by social class. It perpetuates the view that putting students into groups according to perceived ability is the way to deal with academically unsuccessful students.

A Better Deal

Students in general and vocational programs of study deserve a better deal than they are getting. They are entitled to just as much encouragement, rigorous coursework, faculty guidance, planning, and evaluation as students preparing for a four-year college or university. They are not just the majority in high school; they represent the majority in the work force as well.

Most high schools operate on the assumption that by the time students reach high school, their learning patterns are so ingrained that nothing can be done to improve educational achievement. The victims of this assumption are most often young people from poor families, students whose previous success has been negligible, and students who do not aspire to a four-year postsecondary degree.

Too many high schools accommodate the low expectations of the "other" students by offering a smorgasbord of weak, unchallenging academic and vocational courses. These courses, often labeled "basic," "fundamental," or "general," do not provide students with a rich educational experience. Neither do they meet the demands of the workplace.

Seeking a Vision

Ironically, the "other" students are the ones most often in need of inspiration and encouragement. Many times, they seek at school what they do not receive at home—a vision of what they can achieve and a planned program of challenging, engaging studies to guide them in that direction. High schools should strive to be a welcome haven for students rather than a place where they "hang out" until they drop out or graduate.

Despite a decade of educational reform and rising public expenditures for education, little has changed in high schools to

better prepare youth who are bound directly for work or a community college rather than a four-year college or university. As a result, many high school graduates looking for their first job find that they are under-educated for life and work.

There is no question that we need to re-design the way we prepare students in general and vocational programs for the real world. We must upgrade vocational courses to include more mathematics, science, and English; encourage or require students to take higher-level courses in math, science, and language arts; and find new ways to make learning real through meaningful examples and activities.

Essential Elements

Schools must become places where 90 percent or more of students complete essential elements of college preparatory English, mathematics, and science courses. Currently, fewer than half of students—primarily the college preparatory students—are enrolled in high-level academic courses.

Hands-on academic learning filled with lab work and small group activities makes sense to many young people who are turned off by traditional classroom practices. Applied academic learning enables students to relate what they learn to their own lives and experiences and to what they plan to do after high school.

What transforms a high school into a "school that works" for all students? Realizing that major change requires major time and effort, what can schools do to make sure the precious few years students spend in high school are put to the best use?

SREB proposes these strategies:

- ✓ High school principals and teachers must acknowledge that they are doing a poor job of serving 60 to 70 percent of their students, including many who are most in need of leadership and motivation.
- ✓ School leaders and faculty must acquire a new vision for their schools as safe havens for students, many of whom come from troubled homes and neighborhoods. Educators must rise above routine daily tasks to focus on new possibilities, new ideas and techniques, and new attitudes toward the "other" students.

- ✓ School leaders and staff must develop the capacity and confidence to work together to make the necessary changes to help all students realize their greatest potential, to communicate inside and outside their specialties, and to create and take advantage of staff development opportunities.
- ✓ State and local school systems must provide high schools with long-term leadership, support, and technical assistance. High schools need assistance from outside consultants and school system leaders to achieve a new vision of excellence for all students. Schools are much more likely to accept and use outside expertise if they are able to develop a rapport with consultants and view them as knowledgeable resources in helping bring about "whole school" change.
- ✓ Keeping score is essential. An effective external assessment program can help school personnel determine what works and what does not. It can help identify what has changed and the impact of those changes on higher student achievement.

Involve Parents and the Community

In altering the basic operation and instructional practices of high schools, educators must be willing to call on parents, employers, community leaders, and each other for inspiration and assistance in helping all students receive the greatest benefit from their high school years.

Parents must take an interest in what their children are studying in high school. They should be encouraged to confer with their children and a guidance counselor in mapping out a structured four-year program of study and in urging their sons and daughters to enroll in higher-level academic courses and modern vocational courses. Parents should share their knowledge of the high-tech world of work and its increasing demands on employees.

Business and industry must be involved in helping high schools keep abreast of new technological developments at the worksite and requirements for job success in a particular line of work. Leaders can serve on curriculum study committees, recommending programs of study that will lead somewhere for the "other" students. They can sponsor tours and internships to provide teachers and students with a firsthand look at business and industry today.

The SREB *High Schools That Work* program is one of the largest and most promising educational experiments in the nation. In just a few years, it has grown to include 100 sites in 19 states, with encouraging results at schools that have adopted basic guidelines for improvement. SREB's annual staff development conference features nationally known speakers and many workshop sessions on all aspects of academic and vocational integration, including raising students' expectations, upgrading the curriculum, cooperative efforts between academic and vocational teachers, and guiding students to better choices. Teams of teachers, counselors, and administrators attend each year to learn new ways to improve the academic achievement of students in general and vocational programs of study.

Characteristics of Success

SREB pilot sites that have had the most success in inspiring and supporting the cooperative efforts of academic and vocational teachers are alike in these ways:

- ✓ They did not wait until they had everything in place before they began to make changes in the instructional process.
- ✓ They focused clearly and unwaveringly on SREB's key practices and conditions.
- ✓ They did not try to do everything at once. Instead, they focused on one academic area at a time. For example, reading might be the target one year, mathematics the next.
- ✓ They used National Assessment of Educational Progress (NAEP) data on student perceptions of the high school experience, SREB on-site team reports, and other sources of information to plan, modify, and evaluate changes.
- ✓ They received direction and support from state departments of education and from their own district offices. Successful sites welcome assistance. They do not feel they are merely complying with a mandate issued from "on high."

The next step is to create state networks of *High Schools That Work* with a regional infrastructure of assistance and support. Networks will allow schools to participate in regional staff development activities, dissemination of newsletters and other publications, and comprehensive evaluation projects. Belonging to a network will allow schools to share ideas, materials, and ap-

proaches designed to improve the communication, mathematics, and science achievement of students in general and vocational programs. A network will not detract from a school's individuality, but will enable each school to seek and find the best solution for a particular situation.

A Ray of Hope

There is hope for our "other" students. SREB studies show that 90 percent or more of them can complete a more rigorous academic core without increasing the school dropout rate. The key is a faculty that believes it can be done, expects all students to achieve, and is committed to working with students, with each other, and with students' parents to make it happen.

The administration and faculty must be willing to replace the general education track with a program of study that requires all students to complete an upgraded academic core and an in-depth concentration of four to six credits in one of three areas—vocational, academic, or advanced college preparatory study. The academic core in English and social studies should be the same for all students. In addition, each student should be required to complete at least three credits each in mathematics and science. At least two credits in each subject should come from courses with content comparable to that of college preparatory courses.

Counselors must enlist the support of teachers in guiding the "other" students toward a planned four-year program of study that includes tough academic courses and specific vocational studies. They must work with teachers and administrators to revise the curriculum to include opportunities for students in general and vocational programs to follow an academic pathway that runs parallel to that of college preparatory students.

Benefits of Change

High schools in the SREB program are changing to meet the needs of all young people, not just a few. Many more high schools will change during the next few years as they recognize the benefits of academic and vocational integration.

Benefits to Students—The SREB program gives the "other" high school students greater academic and technical knowledge

and skills. These students see the connection between high school and the future and are better prepared to cope with life and work.

Benefits to Teachers—Teachers feel better about themselves and their ability to assist the "other" students. They become part of a team that re-designs the curriculum and plans staff development activities to increase student achievement.

Benefits to Principals—Principals strengthen their leadership skills through new techniques of scheduling, staffing, and curriculum design to offer maximum learning opportunities to all students, not just those entering a four-year college or university.

Benefits to Schools—Schools receive data to identify what is needed to improve the performance of the "other" students in reading, math, and science. The information becomes the basis of an action plan that focuses faculty and administrators on making needed changes. The program results in improved communication between the high school and employers, and between the high school and postsecondary education.

Benefits to the Educational Reform Movement—States acquire new strategies for working with local school systems on a long-term basis to bring about "whole school" change. School leaders and faculties gain confidence that they can increase the achievement of students who do not choose a college preparatory program of study.

Benefits to the Nation, State, and Community—Integrated academic and vocational education raises the mathematics, science, and technical literacy achievement of America's future front-line employees. It improves high school completion rates and increases the number of students pursuing education and training after high school.

Total Revitalization

It is not enough simply to raise expectations, increase the academic content in vocational courses, or add a few applied learning courses. The key to changing high schools for the "other" students is a *comprehensive schoolwide revitalization* that makes all teachers aware of the potential of these students, revises the curriculum, eliminates the general track, requires all students to pursue an upgraded academic core, organizes teams of academic and vocational teachers, counsels students and their

parents about the benefits of a four-year program of integrated academic and vocational study, and provides extra help for students as needed.

A school, an organization, or a nation is only as strong as its ability to inspire superior performance from individual members. *High Schools That Work* are learning new ways to evoke outstanding achievement from promising students who were once overlooked and under-educated.

HOW TO JOIN THE NETWORK OF *HIGH SCHOOLS THAT WORK*

The goal of the SREB-State Vocational Education Consortium is to establish a network of 300 *High Schools That Work* sites at individual schools or school systems.

Requirements for becoming a member include:

- ✓ The site leadership—superintendent, school board, principal, and a core group of teachers—must be willing to commit to a five-year effort to install the Consortium's Key Practices and to either end—or dramatically reduce the number of students who complete—the general track.
- ✓ The local school board must agree to support academic and vocational teachers with staff development, materials, and time to work together to implement the Key Practices.
- ✓ The site must be willing to participate in assessment activities to determine baseline data and to measure progress being made in raising student achievement in reading, mathematics, and science.
- ✓ The site must agree to be an active member of a state and multi-state network for information and idea sharing.
- ✓ The site must have the potential to give students access to modern vocational courses, either at the high school, the vocational center, a postsecondary institution, or in job apprenticeship training. Site leaders must be willing to work closely with employers and two-year postsecondary institutions.

Schools or systems interested in joining the network should contact SREB or their State Director of Vocational Education.

Resources

Accelerated Schools Project
402 S. CERAS
Stanford University
Stanford, CA 94305-3084
(415) 723-0840

The Accelerated Schools model developed from an educational research project at Stanford University in the early 1980s. The project proposes that schools speed up the instruction of disadvantaged students. Originating in two San Francisco Bay area schools, the project has spread to some 140 elementary schools across the nation.

Agency for Instructional Technology
Box A
Bloomington, IN 47402-0120
1-800-457-4509
(812) 339-2203

AIT was established in 1973 to strengthen education through technology. In association with state and provincial education agencies, AIT develops and distributes video and computer programs and printed materials to schools throughout the United States and Canada. AIT developed the applied learning courses Principles of Technology (in cooperation with the Center for Occupational Research and Development), Applied Communication, and Workplace Readiness.

The American Chemical Society
Education Division
1155 Sixteenth Street, NW
Washington, DC 20036
1-800-258-5622
(202) 872-4382

ACS is the world's largest scientific society, with a membership of over 144,000 chemists and chemical engineers. The ACS Education Division manages programs for students, teachers, practitioners, and the public. Its materials include ChemCom—Chemistry in the Community—a hands-on chemistry course for high school students.

American Vocational Association, Inc.
1410 King Street
Alexandria, VA 22314
1-800-826-9972

AVA is the only national professional association representing all components of the vocational-technical education field. The association is dedicated to enhancing the professional development of its members, representing the interests of vocational education at the national level, and encouraging the growth and improvement of vocational education programs. AVA offers a number of tech prep products, and the *Vocational Education Journal* features articles on integrating academic and vocational education, tech prep, and other education initiatives.

Center for Occupational Research and Development
P.O. Box 21689
Waco, TX 76702-1689
1-800-231-3015
Fax (817) 776-3906

CORD is a nonprofit organization established to conduct research and development activities and to disseminate curricula for technical and occupational education and training. CORD's products are used in technical institutes, community colleges, vocational high schools, and industry training programs. CORD developed the applied learning courses Principles of Technology (in cooperation with the Agency for Instructional Technology), Applied Mathematics, and Applied Biology/Chemistry.

Center for Social Organization of Schools
Johns Hopkins University
3505 N. Charles Street
Baltimore, MD 21218
(410) 516-0274
Fax (410) 516-6370

The Center for Social Organization of Schools (CSOS) was established as an educational research and development center at Johns Hopkins University in 1966. The Center maintains a staff of sociologists, psychologists, social psychologists, and other scientists who conduct programmatic research to improve education. The purpose of the Center is to study how changes in the social organization of schools can make them more effective for all students in promoting academic achievement, development of potential, and later-life career success.

National Assessment of Educational Progress
Educational Testing Service
Rosedale Road
Princeton, NJ 08541
1-800-551-1230

NAEP is a Congressionally mandated assessment program used by the U.S. Department of Education and administered by the Educational Testing Service. Known as the "nation's report card," NAEP measures the achievement of students in mathematics, reading, and writing. NAEP's objectives and reports are a valuable resource for teachers in developing innovative and intellectually challenging instructional activities.

National Center for Research in Vocational Education
University of California
1995 University Avenue, Suite 375
Berkeley, CA 94704-1058
(510) 642-4004
1-800-762-4093
Fax (510) 642-2124

NCRVE engages in research and service activities designed to increase the access of all Americans to work that is economically rewarding and personally fulfilling. NCRVE conducts inquiry in a broad range of problem areas and disciplines. It stresses efforts to increase academic rigor in the vocational curriculum and to introduce applied learning in the academic curriculum. The Center is assisted by five subcontractors: the University of Illinois, the University of Minnesota, the RAND Corporation, Teachers College at Columbia University, and Virginia Polytechnic Institute.

New Designs for the Comprehensive High School
R350 VoTech Building
1954 Buford Avenue
St. Paul, MN 55108
(612) 624-1705
Fax: (612) 625-6277

A project of the National Center for Research in Vocational Education, the Design Group for New Designs for the Comprehensive High School is developing a prototype for comprehensive high schools, including integrating academic and vocational education, articulating high school and postsecondary programs, updating the subject matter of vocational and academic education, and building partnerships between schools and communities.

The Parent Institute
P.O. Box 7474
Fairfax Station, VA 22039-7474
1-800-756-5525
Fax: (703) 323-9173

The Institute's purpose is to help parents help their children succeed in school. The Institute provides information on parenting skills and helps schools, other institutions, and individuals meet society's increased demand for parenting skills. The Institute is an independent, private agency founded by education leaders and funded through sale of materials it publishes.

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MAKING HIGH SCHOOLS WORK Through Integration of Academic and Vocational Education

Many of America's high schools do not work for the career-bound students. The fact is, in the achievement of the career-bound students, the high school is an education that fails.

- It does not offer academic and vocational curriculum.
- It does not offer career education track.
- Most teachers are not aware of the potential of the career-bound student.
- Require all students to take an upgraded academic course and either a vocational or an academic minor.
- Offer teams of academic and vocational teachers.
- Show students and parents the benefits of the career-bound program of integrated academic and vocational work.
- Provide extra help for students when they need it.

The SREB Consortium gives us a forum and a network to exchange successful practices with school districts. We share our commitment to strengthen the basic competencies of students enrolled in vocational education programs. The High Schools That Work program is enabling our three high schools to become what and how we teach and what we expect of career-bound students.

Dennis L. Loftus, Superintendent
New Castle County Vocational Technical School District
Wilmington, Delaware

The effectiveness of our faculty in meeting the academic needs of our students has improved significantly since we joined the High Schools That Work program. Now most students are able to connect the inside world of academics and the outside world of the workplace. This linkage virtually guarantees that our graduates will be capable employees who will continue to learn, cooperatively and individually, in the rapidly changing workplace.

John H. Hosteler, Principal
Wallalla High School, Wallalla, South Carolina

The High Schools That Work program has enabled me to create an instructional environment where students can master the math and science skills needed in health careers.

Joan Thomas, Health Occupations Teacher
Bryson County High School, Bryson City, North Carolina